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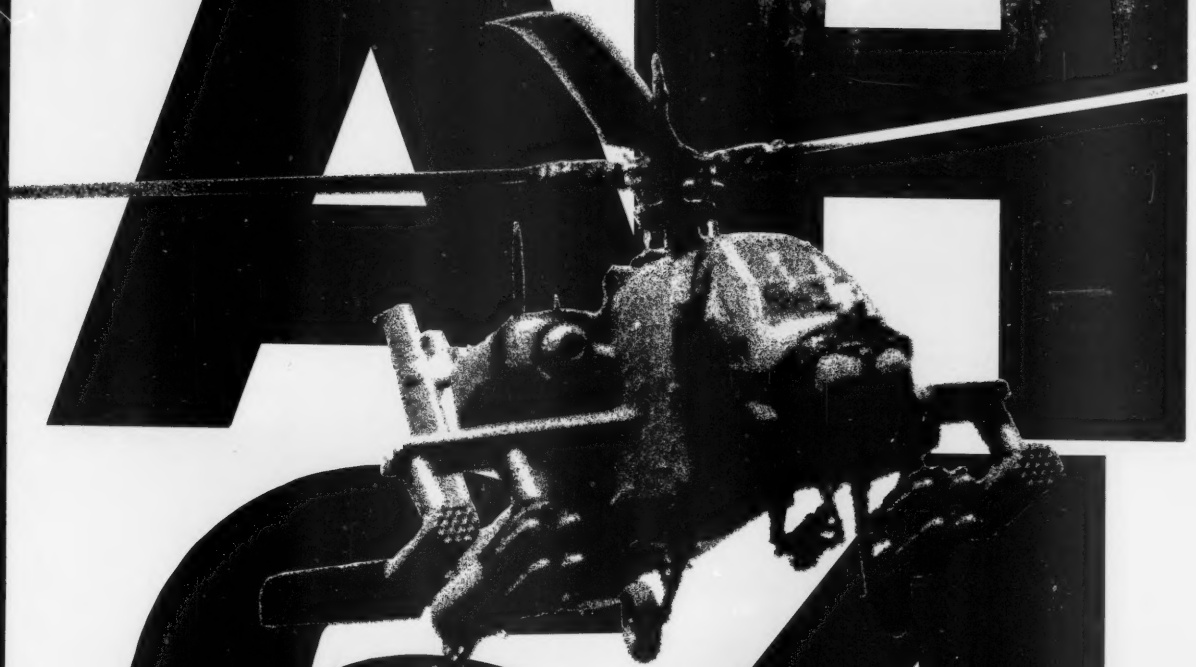
AVIATION DIGEST

JANUARY 1985

AH-64



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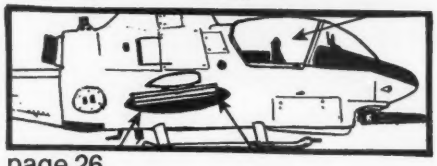

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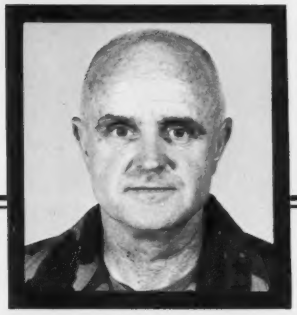
Major General Bobby J. Maddox
Chief, Army Aviation Branch



Commander's Farewell

As COMMANDER of the Aviation Center, and first chief of the Aviation Branch, I have been privileged to be part of many exciting events concerning the development and implementation of the Army Aviation Branch. Much has been said about these events in both the Aviation Branch Update letter and the *Aviation Digest.* There is much more to be said and there are a great many tasks to be completed.

It has been my pleasure to help mold many of the projects concerning Aviation development. The *Aviation Digest* has served the Army Aviation community well by bringing Aviation matters to the forefront and highlighting doctrine, tactics, training and equipment.

Historic milestones and events have been identified, and met. Some of the highlights of those events were: Operational testing for the Army Helicopter Improvement Program (AHIP); contract awards to qualify and integrate Air-to-Air Stinger (ATAS) on our scout aircraft; AH-64 Apache production; the first Aviation Advanced Course and Aviation Basic Officer Course graduations; and the reorganization of the training elements at the Aviation Center to include the first all enlisted training department at the Aviation Center with a sergeant major as director.

All of these events have been reported in the *Aviation Digest* as we have guided Army Aviation through its embryonic stage. We see results because highly motivated professional soldiers and civilians loyally devoted their time and effort to inject innovative ideas into Branch implementation. They are the people we count on. As I leave Ft. Rucker, I can assure you that the team assembled there is superb in every respect.

I challenge each of you involved with Army Aviation to search out problems and offer solutions on the pages of the *Aviation Digest.* I call on everyone in the field to publish — to make a significant professional contribution by writing substantive material which will help shape the Aviation Branch of the future.

It is vital to your professional development, the Branch and the Army to keep continuous technical and tactical information flowing across the pages of this magazine. It is our duty to continuously process this information for the benefit of those charged with the development and growth of the Army's newest and most potentially lethal combat arm.

I leave this command, comfortable with the knowledge that our Branch has measured up to the Army of Excellence for which we are proud to bear the standard. Your untiring efforts and dedication have brought together the dreams of so many who preceded us. Thank you for your innovative leadership, enthusiasm and plain old hard work. You have brought Army Aviation into the 21st century. AIR ASSAULT.

AH-64 and 64 II

TACTICAL LESSONS LEARNED

Cited as being the greatest training experience for combat preparation, the AH-64 Advanced Attack Helicopter Operational Test II (OT II) was conducted during the summer of 1981 at Ft. Hunter-Liggett, CA, using a standard threat scenario where the Threat forces were attacking and the Blue forces were defending. Lessons learned during the OT II will ensure a better doctrine and hopefully lead to a training program with real-time casualty assessment exercises.

Captain Robert L. Johnson Jr.
Chief, Scout/Attack Branch
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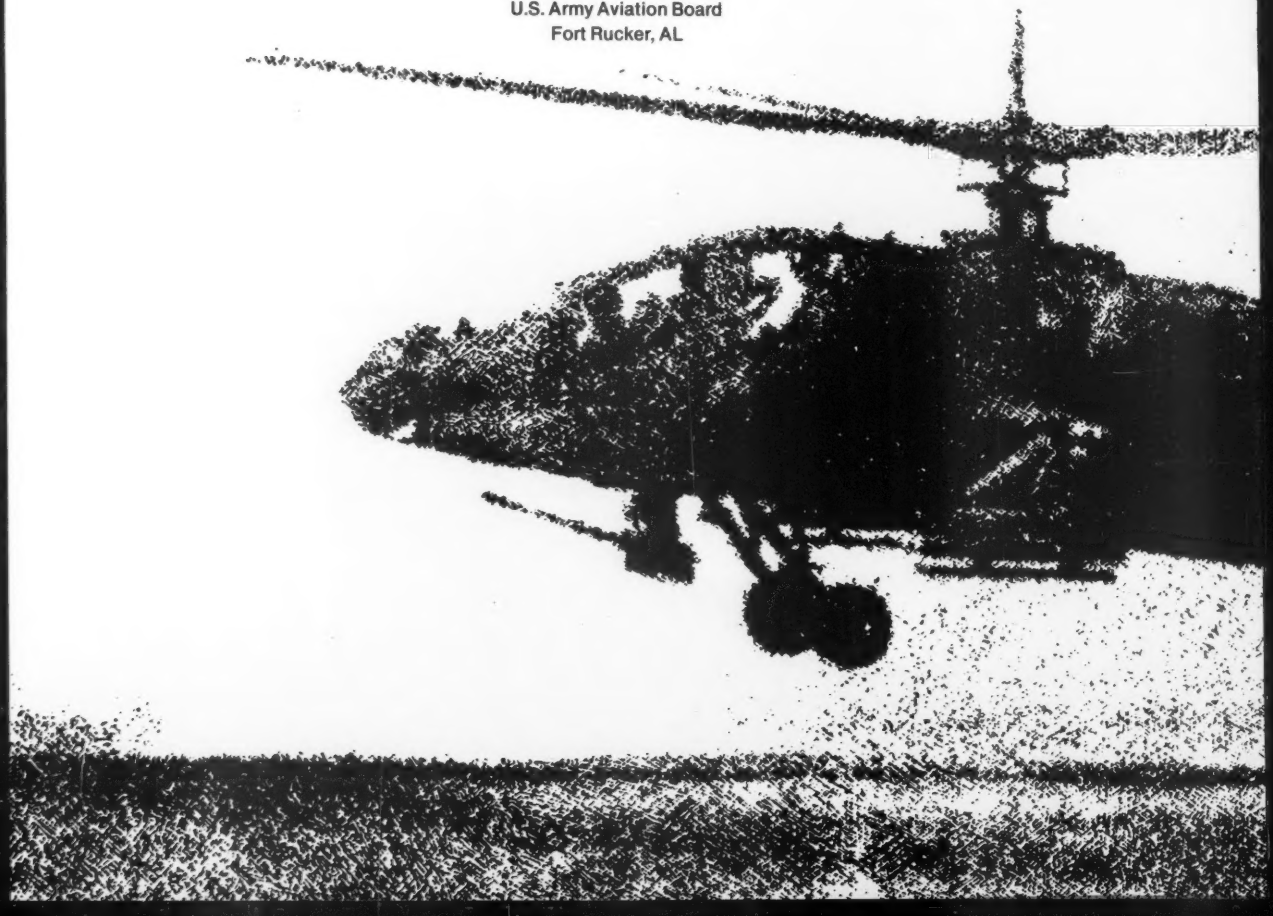
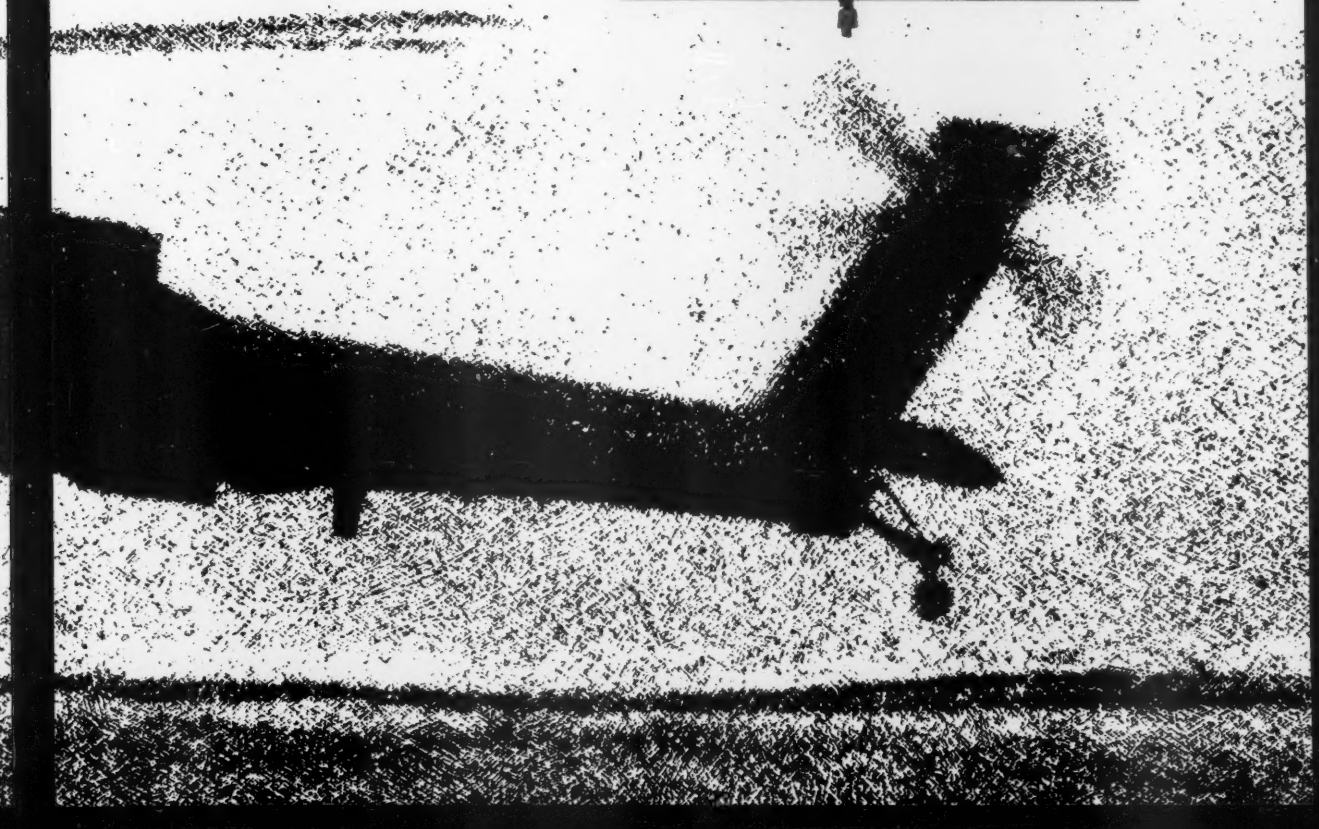


DURING THE summer of 1981, the most advanced attack helicopter in the world, the AH-64 Apache, was pitted against an overwhelming threat force in a free play exercise. The results led to aircraft modifications and doctrinal employment concepts which one day may prove to be the combat multiplier that will ensure victory in any future conflict.

The AH-64 Advanced Attack Helicopter Operational Test II (OT II) was conducted at Ft. Hunter-Liggett, CA. This was a free play, real-time casualty assessment, force-on-force exercise. Threat forces consisted of a reinforced tank company of T-72 tanks (M60A1), BMPs (M113 armored personnel carriers with TOW), one to two SA-8 air defense artillery threat simulators (ADATS), one SA-9 ADATS, two ZSU 23-4s (one ADATS and one

AH-64 Apache aircraft at holding area (below) and returning to base after completing mission (right) during Operational Test II at Ft. Hunter-Ligget, CA.



ZSU 23-A) and four SA-7s (in jeeps and M113s). The Blue force consisted of one tank platoon (M60AI) and an AH-64 platoon consisting of three AH-64s, two surrogate scout airborne target and fire control systems (ATAFCS) and a battle captain in an OH-58C Kiowa. The ATAFCS aircraft were AH-1R model Cobras that incorporated a target acquisition and designation system similar to the AH-64.

The OT II was conducted using a standard threat scenario where the Threat forces were attacking and the Blue forces were defending. The range facilities and all equipment were fully instrumented and allowed for real-time casualty assessment. Each engagement was monitored by computer facilities to determine who the players were (i.e., AH-64 versus T-72, etc.); what the capabilities of the engaging weapon system were (i.e., AH-64 engaging by HELLFIRE missile at "X" range with "X" time of flight, etc.); if the correct parameters for launch, track and hit were met; and, finally to determine if a kill occurred.

The following is a typical engagement sequence: An AH-64 acquires a T-72 and laser designates the target. The laser sensor on the T-72 tells the computer that an AH-64 laser is "painting" the tank and the length of time the AH-64's laser stays on target. The sensors on the AH-64 tell the computer the aircraft's location and if the aircraft has properly gone through all procedures (switchology) necessary to launch a missile. They also tell the computer when the missile is launched.

As the computer gathers this information, it determines if the laser track from the AH-64 to the T-72 is long enough and accurate enough for a missile hit. If so, the computer analyzes the HELLFIRE missile characteristics (range, time of fire, mode of launch, etc.) to determine if it hit the target and subsequently made a kill. If all the data indicates that the T-72 has been destroyed, the computer will transmit a message to the tank and a flashing light will illuminate on the T-72. The vehicle then stops, and a crewmember "pops" a smoke grenade.

All this takes place almost instantaneously so that the flow of battle appears real time. Similar engagements occur simultaneously all over the battlefield. It's almost like fighting a real battle, but with lasers instead of bullets. For those of us who participated in the AH-64 OT II, this was the greatest training experience we could have received to prepare us for combat.

The OT lasted all summer, and we tried to run up to three "trials" a day, with each trial lasting 30 minutes. Each began with an announcement from the test officer to "start trial" and ended when one side or the other became combat ineffective, the Threat forces secured their objective or when 30 minutes had elapsed. The trials varied by the terrain that was used and by certain "distractors" such as electronic warfare played in both day and night scenarios.

The doctrine and employment concepts that we initially developed before the OT, were modified and improved as we gained experience. Although the OT participants in the AH-64 platoon were highly experienced, many problems initially developed in tactically employing the AH-64 platoon. At first, the task overload inside the cockpit of both AH-64 and surrogate scout aircraft often produced less than desirable results.

Operating in a high threat air defense radar environment proved to be most difficult. Despite their vast experience,

Airborne Target Acquisition Fire Control System surrogate scout helicopter is actually an AH-1R Cobra with HELLFIRE missile system.

few of the pilots had ever worked against an ADATS before, and definitely not against the full array of threat air defense artillery (ADA) radar systems at the same time. It was not until we learned how to function in this kind of environment that employment concepts were refined and properly used. It is these employment concepts and tactical lessons learned during the OT that I discuss below in three parts: first, tactical lessons learned during the OT; second, premission planning and battle organization; and third, actual mission employment. These employment concepts are the closest thing to "battle tested" that one can get without firing a live round in combat. With the fielding of the AH-64, now is an opportune time to reflect on the employment concepts and lessons learned during the AH-64 OT II. Furthermore, these lessons learned might enhance new concepts currently under consideration.

TACTICAL LESSONS LEARNED DURING THE AH-64 OT II

Before discussing the employment concepts and premission planning, it is important to look at the tactical lessons learned to understand why the AH-64 was employed in the manner that evolved during the latter portion of the OT.

Organization for Battle. During the OT, only three AH-64 prototype aircraft were available. Therefore, we organized into two sections, each consisting of an AH-64 and a scout. If the third AH-64 was available for the trial, it was assigned to one of the sections and used as the primary aircraft to service ground laser identification and designator (GLID) calls for fire. The battle captain flew in an OH-58C. This was primarily because no other surrogate scouts existed and because we found it was an adequate aerial platform for the mission of the battle captain.

The battle captain cannot simultaneously function as both battle captain and as one of the section scouts. This is because of the sophistication of the various visionics, increased workload as a result of the technological equipment on the aircraft, and the complexity of the interaction between the scout and AH-64. The complexity of the responsibilities of the battle captain and the section scout will become clearer throughout the article.

The battle captain needed a miminum of one very high frequency (VHF), one ultrahigh frequency (UHF) and two frequency modulated (FM) radios on his aircraft to maintain communication between both sections and all supporting ground units, i.e., GLID, artillery, ground commander, etc. With the *extended ranges* and *separations* in which the AH-64 platoon worked, intercommunications between aircraft and between sections became extremely difficult at times. *This was because of the poor ability of the current radios to operate over extended distances in nap-of-the-earth environment.* Intercommunications between air and ground units also proved to be very difficult. The battle captain had to continually move about the battlefield to establish and maintain communication with all of these elements. He had to pass pertinent information about Threat actions from one section to the other because the radios were inadequate for both sections to hear the initial spot report to the battle captain.

The battle captain also had to act as the intermediary in transmitting request for HELLFIRE missile engagements between the GLID and the third AH-64. Whenever possible, the third AH-64 was used to service these requests from the GLID. However, it was the battle captain's responsibility to know where the GLID was, the general location of the target the GLID wanted to engage, and whether or not an AH-64 was available to meet the launch constraints of the missile. Too many missiles were lost initially by allowing the AH-64 to communicate directly with the GLID. The communications problems were such that by allowing the AH-64 to communicate directly with the GLID, it effectively took that AH-64 out of the platoon as a maneuver member.

With a platoon consisting of five AH-64s and three scouts, an organization consisting of a section with one scout and three AH-64s and a second section having one scout and two AH-64s would be best. The battle captain must have his own aircraft. The third AH-64 in the first section should be maneuvered so that normally it is centrally located to more readily meet GLID missions which might arise. Missile launch constraints between the GLID and the target being designated and the location of the GLID with respect to the AH-64 are the driving factors here.

Scouts and Remote HELLFIRE Engagements. Since the surrogate scouts participating in the OT had laser designation capability as well as onboard visionics that were somewhat compatible to the AH-64s', the capability for remote HELLFIRE missile launches existed. Remote shots are important because they allow a higher volume of fire, permit the greatest possible use of the maximum effective range of the

missile, allow the AH-64 to remain masked while firing missiles and provide the opportunity to effect a continuous volume of fire on the threat forces by having the AH-64 fire for a remote designator while the other aircraft is relocating.

However, the initial tendency for the scouts during the OT was to concentrate more on being "killer" scouts than on accomplishing the traditional scout functions. Additionally,the remote shot is difficult to accomplish. It requires good communication between the AH-64 and the scout; requires the scout pilot to ensure that his laser designation is within the constraints of the HELLFIRE missile on the AH-64; mandates an extremely good target handoff procedure over the radio to ensure that the scout's laser is painting the target for a sufficient amount of time for the HELLFIRE missile to lock-on and impact the target; and exposes the unmasked scout for an extensive period. The methods developed for the various calls for fire are in figure 1. Few remote shots were successful during the OT and all surrogate scout losses (kills by

FIGURE 1: Calls for fire.

Call Signs: D11-Scout, A64-AAH, G01-GLID

Standard Call for Fire: 1 Missile, LOAL LO, AH-64 calls "Shot" on launch of missile, on the Scout's code

1. Remote Shot.

CALL: *"A64, D11 RED, Over" (The AH-64 will fire into the center of mass EA Red on D11's code).*

REPLY: *"D11, A64, RED Standby"; "D11, A64, Shot, Over." (AH-64 calls "Shot" on launching of missile to key Scout as to when to designate.)*

2. Remote shot, 2 missiles, 10 seconds between launches (10 seconds is standard time between missiles for remote rapid fire shots).

CALL: *"A64, D11 RED 2, Over."*

REPLY: *"D11, A64, RED 2, Standby"; "D11, A64, Shot, Over." (10 seconds later "Shot Over" for second missile)*

3. Repeat shot, 2 missiles—same mission as 2.

CALL: *"A64, D11, REPEAT 2, Over."*

REPLY: *"D11, A64, REPEAT 2, Standby"; "D11, A64, Shot, Over." (10 seconds later "Shot Over")*

4. Repeat previous mission, then AH-64 goes autonomous.

CALL: *"A64, D11, REPEAT 2, Auto, Over."*

REPLY: *"D11, A64, REPEAT 2, Auto, Standby"; "D11, A64, Shot, Over." (10 seconds later "Shot Over")*

5. AH-64 is told to go autonomous immediately.

CALL: *"A64, D11, Go Auto, Over."*

REPLY: *"D11, A64, Go Auto, Out!"*

6. AH-64 goes autonomous after one remote missile.

CALL: *"A64, D11 RED, Auto, Over."*

REPLY: *"D11, A64, RED Auto, Standby"; "D11, A64, Shot, Over."*

7. Remote shot on a code other than the assigned Scout's code.

CALL: *"A64, D11, RED F, Over." ("F" is laser code AH-64 designates on)*

REPLY: *"D11, A64, RED F, Standby"; "D11, A64, Shot, Over."*

8. Call for fire at my command (used for all GLID missions).

GLID CALLS D11: "D11, GO1, RED, Over."

Battle Captain REPLIES: "GO1, D11, RED, Wait, Over."

CALL: *"A64, D11, RED, F, At my command, Over." (BC calls AH-64 to service GLID) (GLID is working "F" code in this case)*

REPLY: *"D11, A64, RED, F, At your command, Out!"*

CALL: *"A64, D11, FIRE, Over."*

REPLY: *"D11, A64, FIRE, Out."*

CALL: *"GO1, D11, SPARKLE, Out!" (This is call to GLID to designate)*

9. Target of Opportunity.
Three types of Call for Fire:

a. ID, EA, Over, Remote Shot.

b. ID, Auto, AZ, Rg, Tgt Type—Scout passing mission to AH-64 for direct shot.

c. ID, AZ, Over, Remote Shot—Scout will designate, but wants AH-64 to point (azimuth) toward target to put AH-64 in constraints.

Threat forces) occurred while scouts attempted remote shots. Therefore, because of the above mentioned problems, *the autonomous direct shot by the AH-64* (in other words, self-designation) *was by far the most effective means of engaging targets during the OT II.*

Scouts should attempt remote shots only when targets of opportunity arise, during initial engagements when AH-64s are outside the maximum effective range for (autonomous) direct shots, or during situations when a maximum volume of fire is wanted on targets, such as a tank battalion that is caught in the open. The scout's role is critical in the section. The "killing" should be left to the most efficient killing machine, which is the AH-64.

There were times during the OT that scouts became so involved in trying to be "killer scouts" that they lost contact with sections of the Threat forces. Many times the volume and effectiveness of fire was decreased because the scouts were trying to fire remote shots at targets that would have been more efficiently serviced by an AH-64 firing direct. This was a hard lesson to learn, and it wasn't until the latter part of the OT that a proper balance between remote shots for the scouts and direct shots by AH-64s was struck.

Battle Positions. A number of things were learned about fighting and selecting a good battle position. All the factors in selecting a battle position as stated in the field manuals are valid, but a few need elaboration. *Background* is critical. A battle position which has a background makes detection of an aircraft by both optical and electronic means extremely difficult—as opposed to an aircraft being skylined when unmasking. This applies regardless of range to the target. If the battle position and background are in the *shade,* the detectability of an unmasked aircraft is further decreased making it almost impossible to see. This is the best combination that an aircraft can find (background and shade).

The battle position has to have *intervisibility* with the various engagement areas. Given the ranges at which the AH-64s were engaging and the terrain in which the fighting was occurring (Ft. Hunter-Liggett was hilly and cluttered with trees), *altitude* is critical in gaining intervisibility. The greater the altitude of the battle position, the easier to acquire and track a target with the visionics onboard the aircraft. The lower the altitude, the closer the pilot had to get to the target to engage it.

Remember that when firing a TOW missile you can continue to track a moving target in a cluttered wooded environment as long as the missile hasn't entered the woods. Also, if the target is moving in and out-of-folds in the earth, you can still track the TOW missile to where you expect the target to reappear.

With a HELLFIRE missile, things are different. Once the missile is launched, it guides on the laser energy painted on the target. If the target is moving through a cluttered, wooded environment, the laser beam may be deflected by the clutter and send false signals to the missile about the target's location. If the target moves into a fold in the earth while you're tracking it, and you don't shift to some type of solid ground target to get a constant laser return, you run the risk of losing the missile. Therefore, *altitude* is critical in selecting battle positions to maintain your standoff range and intervisibility with the target.

Another key to selecting a good battle position is to find one that has a portion of the terrain which masks you from the threat ADA radar (primarily SA-8/ZSU 23-4). Using certain portions of the terrain (a large boulder, rocky knob, etc.) to mask your aircraft signature prevents the threat radar from "locking" on you even though it knows you're in that area. Until we learned how to use the terrain in this manner—to prevent radar lock-on during the OT—we were not an effective fighting force. It seemed that every time we stuck our heads up to take a look, we were being searched, acquired and locked-on in a matter of seconds. If a threat radar system can prevent you from engaging the threat forces simply by using its radar systems (without having to fire a shot), it has fulfilled its mission and prevented you from completing yours. Once we learned how to use our APR-39s and to properly select the terrain from which to unmask, we became extremely effective.

To prevent the ADA radar lock-on, we began adjusting many of our techniques. Often the scouts would run "decoy" missions. They would position themselves away from the AH-64, beyond range of the ZSU 23-4, in a shaded battle position to prevent visual acquisition and use the APR-39s to tell us where the radar systems were coming from. We would then "occupy" the radar systems by allowing them to acquire and sometimes lock-on (immediately breaking lock) to fix the attention of the radar operators on the scouts. This afforded the AH-64s an unhindered opportunity to engage the Threat forces.

I do not recommend this technique unless the scout crews are thoroughly familiar with the use of their APR-39s, the capabilities and limitations of

threat radar systems, and they are thoroughly knowledgeable in using the terrain to select battle positions. As a point of interest, no casualties were taken while using this decoy technique.

Flank shots are invaluable. I cannot say enough about this. It is to your advantage to select a battle position that will permit flank shots into your engagement area. Also, if you find a good battle position which allows you to engage the threat without being acquired, you should continue to use that position until you are forced to relocate: This was a very interesting development that came out of the OT. Every once in a while we ran across a perfect battle position which afforded the desirable characteristics mentioned. We found it better to stay in such a battle position and fire 8 to 10 missiles instead of relocating 5 to 6 times and firing the same number of missiles. This causes a lot of heartburn with "book" tacticians, who teach staying in a battle position only long enough to fire one missile (sometimes two). I agree that for TOW missile engagements that is true. However, when fighting with AH-64s firing HELLFIRE missiles, and given a battle position with the characteristics mentioned (i.e., with shade, background, altitude, allowing flank shots and lateral unmasking), and when the position is in *excess of 3 km* from the Threat forces, firing 8 to 10 missiles is more expedient, efficient, and creates a more accurate and higher volume of fire.

During the OT it was not unusual for the AH-64s to have fired all 16 missiles before leaving the second battle position. Here's why: In the time it takes for an AH-1 Cobra to engage two targets at 3 km from a battle position, an AH-64 can engage eight targets. In a target-rich environment the rapid fire capability of the AH-64 permits a more effective employment if the aircraft remains in a good battle position than if it continues to relocate when it is not necessary. If you add the ripple fire capability of the AH-64 (when the AH-64 gunner is launching a missile for a remote designator for every missile fired for himself) to the same scenario, you find the AH-64 might possibly launch all 16 missiles and destroy 16 targets in the time it takes a TOW Cobra to destroy two targets.

Specific Engagement Areas. When selecting engagement areas during premission planning ensure that these areas are specific and not just big goose eggs on your maps. The AH-64 can program the Target Acquisition and Designation System (TADS) to reflect the grid coordinates of the center of mass of each engagement area you use. This aids in rapid acquisition for the AH-64s when they're moving. The TADS can be "pre-pointed" so when the AH-64 unmasks, the TADS is looking right at the engagement area. Also, the more specific your engagement areas are, the easier it is to pass threat movements and locations to all members of the team.

When selecting an engagement area, choose an area that maximizes your aircraft capabilities. It is better to engage the threat in a specific area which allows you standoff, intervisibility, etc., even if these specific engagement areas are separated by several kilometers. If you try to fight the AH-64 throughout the entire terrain on a continuous basis you negate many of the favorable characteristics of the system. The AH-64s will be forced to get closer to the threat to engage them, creating situations where the AH-64s will be

selectively and individually engaging targets instead of engaging many targets with a massive volume of fire. It is in these situations (between engagement areas) where the scouts are more efficient. The scouts, with their smaller profiles and mast mounted sights, can engage selected targets of opportunity while maintaining contact with the Threat forces, using remote shots. This allows the AH-64s to position themselves for a massive firepower release as the Threat forces move into the engagement area.

Night Fighting and a Compatible Scout Aircraft. Another fact which became obvious during the OT was the night fighting capability of the AH-64. Ground forces have a tendency to bunch up when moving or attacking at night. They also tend to move across more open areas which enables them to better see where they are going. These facts tend to make the AH-64 extremely effective in that it can quickly move about the battlefield using the Pilot Night Vision System (PNVS) and can engage targets with the forward looking infrared radar (FLIR) system. Without a doubt the AH-64 is the finest night fighting aircraft in the world. However, one fact that came out of the OT loud and clear is that a scout aircraft with compatible visionics (both day and night) is essential. When these two aircraft are employed together the synergistic effect on the battle is remarkable. To employ the AH-64 without a compatible scout implies using only half of the system's capabilities. Employing the AH-64 with the OH-58C means the same thing. The OH-58C does not have the visionics or a designation capability, and it is slow and unmaneuverable. To send the AH-64 out with this aircraft, particularly at night, is to virtually put a leash on the AH-64. It can be compared to sending out a scout on horseback in front of an armor battalion of M1 tanks. The bottom line is that if you want to maximize the effectiveness of the AH-64, and get the high kill ratios that are expected, the AH-64 must be employed with a compatible scout aircraft.

Although many more lessons were learned, those mentioned above impacted directly in the evolution of the employment concepts used during the latter stages of the OT. Because of the complexity of the fire control system of the AH-64, *thorough premission planning is essential.*

PREMISSION PLANNING

Probably the most important ingredient to successful employment of the AH-64 is premission planning. A complete mission brief is always important; however, there are some unique items of information which must be given to the crews of the AH-64 platoon to maximize their efficiency. Since a large volume of information needs to be copied down and later made accessible to the crew, it becomes apparent that some means has to be developed to ensure that crews get the proper information, copy all pertinent items and have access to it quickly once they are in the cockpit. This was accomplished by two things:

- A standard mission brief in the company tactical standing operating procedure was used by the battle captain when briefing.
- An information sheet the size of your kneeboard which left blanks for all required information to be copied down.

Figure 2 is a copy of the sheet used during OT II. This sheet was acetate covered so that all the information could be marked down with a water soluble pen and quickly erased for the next mission. This sheet and its interaction with premission planning was invaluable.

Note that the front side of the information sheet is divided into columns. The first column is for call signs to be used during the mission. The second column is the storage address in the fire control computer (FCC) in which the laser code (column 3) is assigned to that aircraft. Column 4 contains the primary radio frequencies that particular aircraft will be using. *Each scout and AH-64 aircraft must have a predetermined laser code (and*

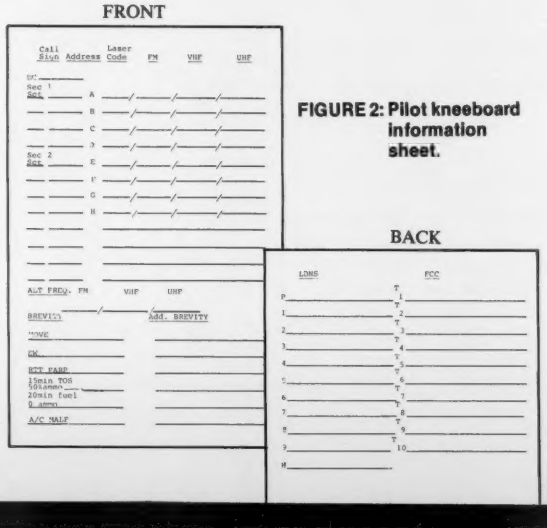


FIGURE 2: Pilot kneeboard information sheet.

Brevity Codes		Meanings
1. Set	(NC)	Set in initial position
2. Dead Bug	(NC)	Malfunction A/C
3. Standby	(NC)	Self-explanatory
4. Abort	(NC)	Self-explanatory
5. ZSU 23-4 285	(NC)	ZSU point at 285°
6. SA-8 265	(NC)	SA-8 point at 265°
7. SA-6 245	(NC)	SA-6 point at 245°
8. No Joy	(C)	No targets in the engagement area
9. Game Time	(C)	Start problem play
10. Playboy	(C)	ECCM Fox / FM; Victor / VHF; Uniform / UHF
11. Joker	(C)	Return to FARP
12. Bingo	(C)	50% HELLFIRE ammo remaining/20 minutes fuel on station
13. Burnout	(C)	0% HELLFIRE ammo remaining/10 minutes fuel on station
14. Wait	(C)	Self-explanatory
15. Sparkle	(C)	Signal for GLID to designate

FIGURE 3: Brevity code words.

(NC) Code words do not change
(C) Code words change daily

address) prior to beginning the mission. **If AH-64 #2 of Section 1 is assigned laser code 1141 and stores that laser code in address (C), then everyone in the platoon knows what code AH-64 #2 is working for direct, autonomous engagements. If the scout for Section 1 is assigned a laser code in address "A," then all aircraft know what code scout #1 is working for remote shots and for laser range finding. Notice that the call for fire for a remote shot is simply, "A64 (AH-64) this is D12 (Sct), RED OVER"—(RED is the engagement area). This means that the AH-64 will launch a HELLFIRE missile with the scout's (D12) laser code programed into the missile, toward engagement area Red. Consequently, when the missile is launched, it will begin searching for the laser spot being designated by the scout (D12) and home in on that particular laser frequency.**

By assigning each aircraft a laser code and address, any aircraft can communicate with any other aircraft for a remote HELLFIRE engagement and all parties involved know which laser code to use. This precludes any lost missiles because of improper or incorrect laser code use. This also aids in remote HELLFIRE engagements using a GLID.

When establishing initial contact with the GLID, the battle captain verifies the laser code the GLID will be working in support of the AH-64 platoon. The battle captain also tells the GLID the storage address in the FCCs of the AH-64s in which his code is located. Therefore, when a "GLID shot" is called for, the initial call for fire to the AH-64 from the battle captain is, "A64 this is D11, RED H (Hotel), OVER." In this case the AH-64 will launch a HELLFIRE missile with the "Hotel" address and laser code programed into the missile. This procedure of assigning specific addresses and codes facilitates the organization and control of missile engagements and simplifies the calls for fire.

FIGURE 4: Electronic warfare operations procedures.

CONCEPTION:

(1) Primary consideration is to get the AH-64 into the engagement area as soon as possible to maintain a high volume of fire.

(2) It is imperative that the AH-64 pilot gain and maintain intervisibility with his assigned scout.

(3) The scout's job is to get the AH-64 into the engagement area so that it can engage autonomously.

(4) Worst case, the AH-64 pilot acquires the engagement area as soon as possible to continue the battle if he has lost visibility with his scout or the scout is rendered ineffective.

TECHNIQUES:

(1) Radios:

(a) Attempts to work through jamming on assigned frequency;

(b) Calls battle captain on unaffected radio frequency:

i.e. PLAYBOY Fox / FM Victor / VHF Uniform / UHF

(c) Battle captain calls "Execute PLAYBOY FM," that is the time to switch to alternate frequency.

(d) If all three radios on both primary and alternate frequencies are jammed, then and only then, the team will go to the use of SAM cards.

(2) SAM Cards:

(a) The battle position occupied by the AH-64 pilot will designate the engagement area into which he should orient his fire.

(b) Gaining intervisibility with assigned scout by:

1. HSS/IHADSS
2. TADS Pre-Point
3. Naked Eye

SAM CARDS SIGNALS:

(a) Scout will remote the first missile, after missile launch the AH-64 goes autonomous.

(b) This enables the scout to get the AH-64 into the desired engagement area.

(c) If the scout shows the remote card again, that will terminate that engagement.

The AH-64 will go autonomous immediately

Move to EA (Red)

Move to EA (Blue)

Move to EA _____

Move to EA _____

PROCEDURES:

(a) The AH-64 pilot acknowledges the assigned card by turning on his WHITE strobe light for 10 seconds and the scout takes the appropriate action. If the scout does not acknowledge, the AH-64 will then go autonomous.

(b) Cards 3-6 are used for movement. Cards 1-2 are used for execution once in position.

(c) On a remote shot once the scout pilot sees the acknowledgement from the AH-64, he turns back toward the engagement area, unmasks and designates his target. The AH-64 fires on the scout's unmask, then spot tracks to acquire the specific sector of the engagement area.

(d) Log books held up to the window means BURNOUT—return to the FARP.

As you can imagine, remote HELLFIRE engagements require extensive use of the radio; therefore, it is essential that each section have a primary frequency on which to conduct internal section calls for fire. During the OT, the FM radio was usually used as the platoon frequency; the VHF, for one of the section's primary frequencies, and the UHF, for the other section's primary working frequency.

Below these columns on the information card are the primary and alternate frequencies for the platoon. At the bottom of the card are the brevity codes. During OT II some code words were never changed and some were changed daily. Figure 3 lists the brevity codes used during OT II. The brevity code is important because it decreases the use of the radios. It also expedites procedures such as operations in an electronic warfare (EW) (i.e., jamming) environment. See figure 4 for EW procedures.

The SAM (send-a-message) cards used in figure 4 are simple and can be seen in all of the AH-64's sighting systems, including FLIR, out to 2 km.

On the back side of the information card are columns for writing down the coordinates for the onboard Laser Doppler Navigation System (LDNS) and for those coordinates to be stored in the FCC, which require eight-digit coordinates and elevation of that coordinate.

Hopefully, this article sheds some light on the AH-64 unique type information that needs to be provided during the mission brief and the premission planning stages of an operation. Using the background information discussed before in the lessons learned and premission planning sections of the article, let's briefly look at tactical employment procedures during a defensive operation.

TACTICAL EMPLOYMENT DURING DEFENSIVE OPERATIONS

The mission brief is conducted at the assembly area. From the information provided in the mission brief, the AH-64/scout crews program their onboard equipment (FCC, Doppler, laser codes, etc.). Following this programing, the crews conduct a functional systems check, including boresighting their respective systems, Doppler, commo checks, etc. Once all systems are programed and checked out, the aircraft is flown to the holding area. Upon arrival at the holding area, the AH-64s usually shut the engines down and run on their internal APU (auxiliary power unit) to save fuel. The scouts and battle captain depart the holding area and move forward to establish contact with the ground commander, with GLID, and recon the battle positions, etc. The battle captain receives a situation update from the ground commander and makes contact with the GLID to inform him which laser code/address he is to work.

As the Threat forces approach the selected engagement area, the AH-64s are brought forward. The AH-64s should select initial battle positions at a distance such that the Threat forces enter the engagement area in the vicinity of the maximum effective range for direct fire (see figure 5). The scouts should select initial positions that will allow them to cover the area which extends from the limit of the AH-64's direct fire range to the maximum effective range of the missile. Keep in mind the fact that the scout who is designating the target must be within a range to the target which does not exceed the maximum effective range for direct fire for the scout's laser (figure 6, page 12). This allows the scouts to begin engagement using the maximum effective range of the missile while the AH-64s are masked and while the Threat forces are outside the maximum effective range for direct shots by the AH-64s. The scouts should select priority targets to engage, i.e., ADA, command and control, tanks. This is done in an attempt to strip the attacking Threat forces of their ADA support (ZSU 23-4, SA-8, etc.) and disrupt their command and control.

As the Threat forces move into the engagement area within direct fire range of the AH-64s, the scouts designate the AH-64 to begin autonomous engagements. By using the pre-pointed TADS on the aircraft, the gunner of the AH-64 should be looking directly into the center mass of

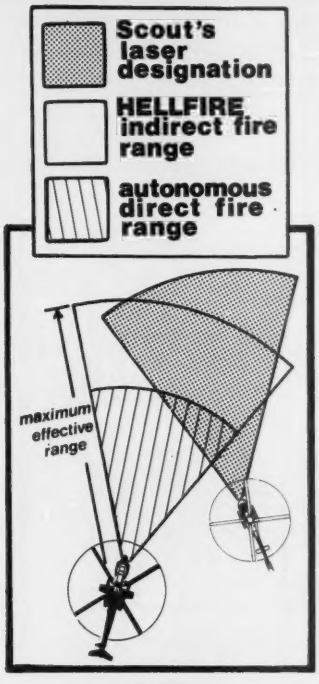


FIGURE 5

the engagement area as he unmasks. If for some reason the AH-64 crew is unable to acquire the Threat forces, the scout can laser designate the threat target and allow the AH-64 TADS to "laser spot track" to the target the scout is designating. The scouts relocate and provide local security for the AH-64 as well as continue with the other traditional scout functions.

As the Threat forces move to where the AH-64s are within direct fire range of the ZSU 23-4, the AH-64s relocate to engage the threat from the next battle position. If the next suitable engagement area is several kilometers away, the AH-64s should relocate and prepare for that engagement. Since the scouts are maintaining contact, they continue to engage targets of opportunity with remote shots from the AH-64s. This ensures that a continual attrition of the Threat forces is occurring. However, the scouts should only engage targets that allow clean shots. They should not waste missiles trying to hit a target whose engagement is questionable. If the scouts cannot hit the target between engagement areas because of the terrain, the AH-64s will get the targets as they move into the next engagement area (figure 7). As the Threat forces move into the next engagement area, the AH-64's begin direct fire engagements.

Relief on stations should be coordinated so as not to interrupt the flow of battle. I believe that relief on stations will need to be conducted more frequently because of the ability to rapidly engage targets and expend missiles. The more frequent the relief on station, the greater the pressure that is placed on the forward arming and refueling point (FARP) for reloading the aircraft and getting them turned around and back in the battle. The number of armament people in the FARP must be closely scrutinized to ensure that there are enough to facilitate rapid reloading of aircraft.

I have discussed the lessons learned during the AH-64 OT II in the tactical employment of the AH-64. I also discussed how these lessons contributed to the evolution of the employment doctrine used during the latter stages of the OT. These concepts were successful; however, a great deal of that success can be attributed to the experience gained from the real-time casualty assessment trials conducted during the OT. The best equipment and doctrine in the world are only as good as the people who use them. Hopefully, these lessons learned will lead to not only a better employment doctrine, but also to a comprehensive training program with real-time casualty assessment exercises using threat radar systems. If this occurs, the new concepts under consideration today might profit from the experiences of the past.

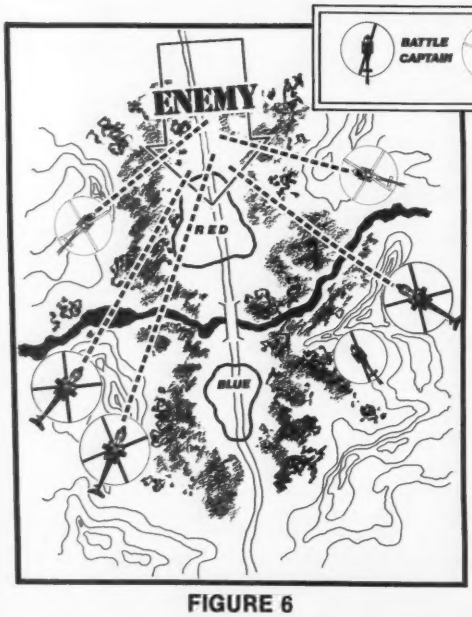


FIGURE 6

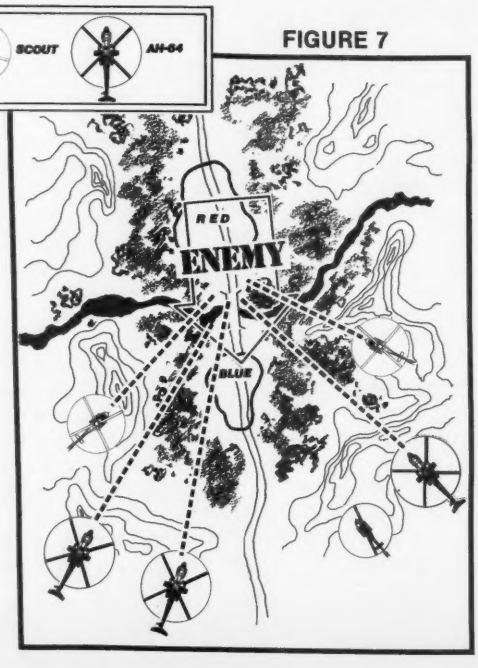


FIGURE 7

U.S. Army

Aviation Board Adds New Dimension

The Army's newest simulator, the 2B40 AH-64A Combat Mission Simulator (CMS), will be used to train AH-64 aviators in combat skills. Capable of flying virtually all modes of terrain flight in various weather conditions, the AH-64A CMS will allow you to perform a multitude of simulated combat procedures, all in air-conditioned comfort.

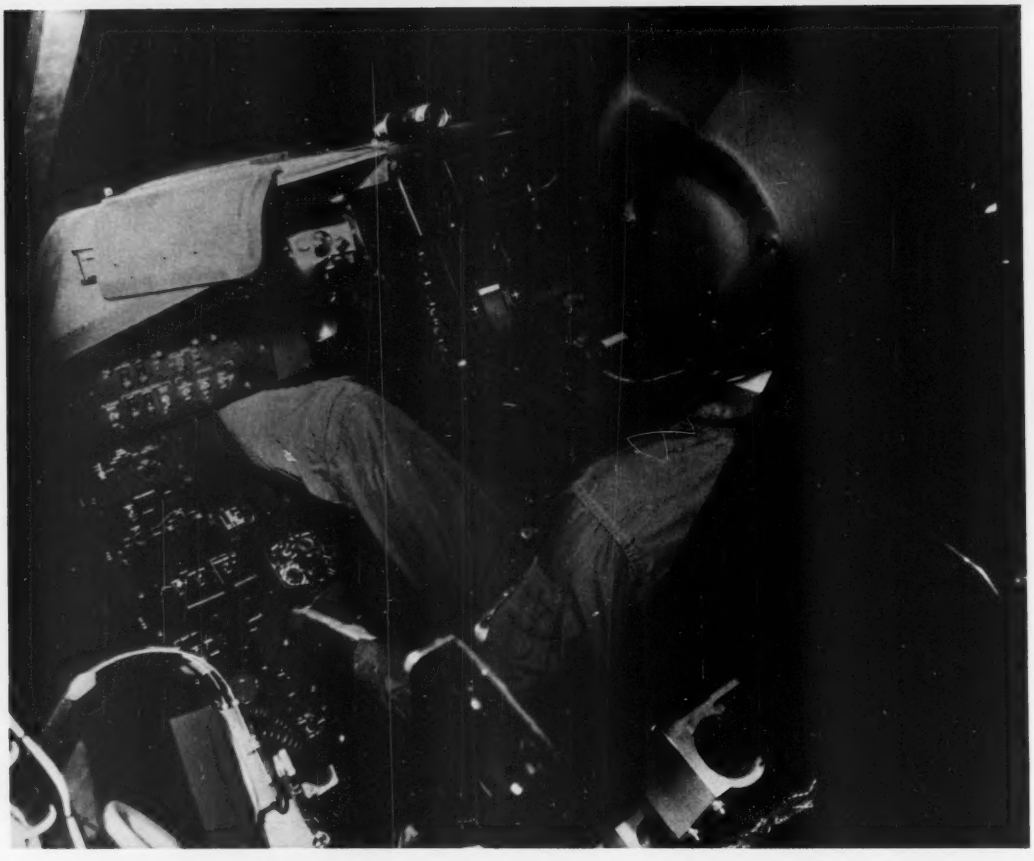
Helmet Mounted Visual System is just one test being conducted by the Simulation Branch. Photo courtesy of McDonald Douglas Electronics Corporation.

CW3 Ray E. Stanton
Chief, Simulation Branch
U.S. Army Aviation Board
Fort Rucker, AL

THE SIMULATION BRANCH is the newest addition to the United States Army Aviation Board at Ft. Rucker, AL. The job of our branch is to test flight simulators, to ensure that you, the users of these devices, are receiving the best possible equipment that technology can provide. Now, when you have a complaint, you know at whom to point your finger.

When we test a device, a training concept or an improved software package, our prime consideration is the aviator who will be required to use it at the organizational level. Since flight simulators have not been around as long as the aircraft they represent, that's not an easy job. The technology which has caused the evolution of flight simulation to the current state of the art has grown faster than the general aviator's knowledge of electronics, computer science, fluid mechanics, dynamics, methods of visual scene representation, audio cuing, motion replication and system management. Consequently, our knowledge of flight simulators is continually expanding.

This rapid growth within the industry has caused the Army to reassess the purpose of flight simulators. Think back to your days of flight school. Do you remember a device called the "Blue Canoe"? Or, maybe, the instrument training you received in the 2B24 Huey instrument procedure trainer? It was really great when we finally had a simulator that had a cockpit which looked and responded like that of the UH-1 Huey helicopter. All the gauges worked like the real thing! The radios really could be tuned and the same emergency conditions which could occur in the aircraft could be duplicated and actually experienced in the simulator while you sat in air-conditioned comfort. Sure, the simulator didn't really fly like the real aircraft, and one of the older, more experienced aviators once told you that some of the emergency setups weren't the way he had ex-



View of copilot/gunner's station (above) of AH-64 CMS 2B40.

View of pilot's station (next page) of AH-64 CMS 2B40.

View of instructor/operator's station (left) of AH-64 CMS 2B40. Note simplicity of control arrangement and added monitors.

Photos courtesy of Link Flight Simulation Division, Singer Company.

perienced the real thing. But it sure beat having to go out and try to fly hood or challenge actual instrument meteorological conditions to meet minimums.

Thanks to the breakthrough of microcircuitry and the overall progress made in simulation design, we now have a simulator that will allow you to start; run-up; hover or ground taxi; takeoff; land; fire weapon systems; practice chemical, biological and radiological procedures; electronic countermeasures; and engage a host of threat vehicles and aircraft. It will fly all modes of terrain flight in day or night lighting conditions and in virtually any type of weather (sorry, they haven't figured out how to simulate precipitation yet), while using various types of sensors or night vision goggles and much, much more. And you can still do all this in air-conditioned comfort!

One such simulator is the 2B40 AH-64A Combat Mission Simulator or better known as the CMS. It is currently in the plant at Link Flight Simulation Division, Singer Company, Binghamton, NY, and is the latest in the Army's family of flight simulators. The simulator will be used at the Aviation Center at Ft. Rucker to train AH-64 Apache aviators in combat skills. For 15 hours of simulator time, each crew of two students will be subjected to the most challenging environment ever created for the training of aviators. The types of missions which the newly qualified AH-64 aviators will be expected to accomplish once they arrive at their units will be covered in 10 flight periods.

But this isn't all. Technology doesn't stand still. New methods of displaying the visual scene are evolving. In the not too distant future, you will have a full 360-degree field of view in both the horizontal and vertical plane. Perhaps you'd like an improvement in depth perception, texturing of objects within a scene, or actual terrain representation of any locale in the world. All are being developed by industry, and these developments will improve the realism and training effectiveness of future simulators. With such growth in the industry, how does the Army effectively use this equipment? What is the most cost effective mix of simulator and aircraft hours? Are we now capable of overloading the student or the instructor? What will be the reliability, availability and maintainability for these devices?

At present the Simulation Branch has 12 tests scheduled to address questions such as these. The first test scheduled concerns the Helmet Mounted Visual System (HMVS). This particular test is being done to assess the utility of a new method of displaying the simulated visual scene. All of the present Army visual systems use a television screen from which an image is collimated and reflected to present the visual scene in front of the cockpit window structure. The result is a fairly good representation of the outside world as viewed from the pilot's seat. HMVS brings the visual display to the student's eye. Mounted to the helmet are two small cathode ray tubes which are also collimated and reflected to bring the image around and in front of both eyes in much the same way that the Pilot Night Vision Sensor (PNVS) is displayed to the pilot of the AH-64A. We will be examining the overall suitability of this method of scene display. Maybe someday it will be the method used on our next generation of simulators.

The next test concerns the AH-64 CMS. This is a three-phase effort which begins with an in-plant evaluation of the simulator. Our first look will be to verify that the simulator meets the requirements of the Aviation Center and if we note any problems to document and have them corrected before the device is delivered to Ft. Rucker. Bear in mind, however, that we are not the first to examine the CMS. The

manufacturer will have already demonstrated through testing that the device will function as advertised. Also, the Government, through the office of the PM-TRADE (Program Manager for Training Devices), will have had the Aviation Development Test Activity test the simulator to ensure that it is in accordance with the design specifications. We then examine the CMS to make certain that it will do the job the Aviation Center had in mind.

Next, we again test the device after it is installed and ready for use to train at Ft Rucker. At this stage, our purpose is to assist the Aviation Center to best use what it has bought to train Apache pilots. Finally, we will test the simulator at a Forces Command installation to determine how it can best be used to maintain individual aviator and aircrew proficiency in the Apache.

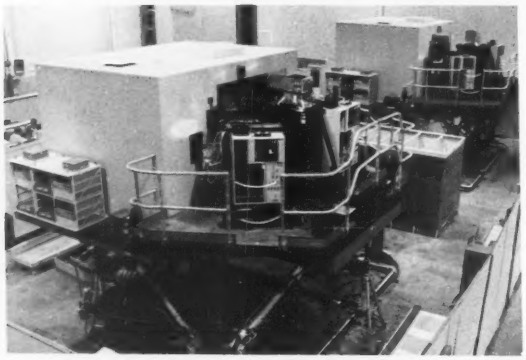
Remember, simulators cannot be used to replace flight hours. They can only be employed to augment flight hours by providing a higher quality of training relative to the tasks for which the device is best suited. Some tasks are best trained in simulators; others, in aircraft. This same theme carries over to the AH-1 Cobra and CH-47 Chinook simulators. Both of these simulators are being upgraded at existing facilities or planned to be newly installed at other installations. The problem with these two simulators (as with all simulators) is that the individual needs of the aviator to train by means of a simulator vary while the regulatory requirements do not (20 hours per annual period, etc.). This seems to be a very poor method of management of the Army's resources. Precepts are changing and we hope to help by better defining how the use of simulators can be improved. Cost effectiveness and maximized training effectiveness do go hand-in-hand, particularly when the commander is given the latitude to customize each aviator's training program to that person's individual needs.

Other questions which we will address in the near future include the following:

- Which gunnery tasks are best trained in the simulator and which are best trained in the aircraft?
- How much training does it take for an attack pilot to really peak his performance?
- How much training time does it take to sustain him at that peak?
- What is realistically affordable to the Army when considering peak performance and cost?

These issues will be addressed during a training effectiveness analysis planned for the AH-1S (MC) Flight Weapons Simulator (FWS).

Pilots' and copilots' station visible on 2B40 (AH-64) Combat Mission Simulators at the manufacturer.



There is also a possibility that we may be permitted to assist the Aviation Center in the use of its newly updated AH-1S (MC) FWS. You may recall that the current Aviator Qualification Course program of instruction (POI) only uses the device for 3 hours of gunnery tasks. The updated simulator should allow the incorporation of better combat skills and emergency procedures into the POI for the AH-1 aviator. Hopefully, a better trained course graduate will be the result.

The remaining tests are not scheduled for several years. They include the Operational Test II for the scout and attack team simulator, the SEMA (special electronic mission aircraft) simulator (the first mission oriented fixed wing simulator the Army has tried to purchase, and one that is badly needed), and a trainer aircraft laser for the AH-64.

So there you are. That is what we will be doing for the next 4 years in operational testing of flight simulators. But there is so much that needs to be done and we need your help. If you have a need, whether it is related to concepts, doctrine, training or materiel, and which you feel would improve the system, let us know. The Simulation Branch will do everything in its power to ensure that you receive the best simulators possible.

The Aviation Board is your representative for the test and evaluation of Aviation related items. Without feedback from the field we can only guess what you want. The majority of us are active duty military with extensive TOE (table of organization and equipment) experience. We have been where you are and will rejoin you again once our tours at Ft. Rucker are completed. We do understand. Call or write us and let us know what you think. If you would like to hear more about what is currently in the testing cycle or what we do, tell us that too.

AVIATION DOCTRINE & TRAINING Literature

DOCTRINAL publications are key to the development and integration of the Army Aviation Branch. To keep pace with new forces design and changed battlefield doctrine, new Aviation doctrinal manuals continue to emerge. The goal of the U.S. Army Aviation Center at Ft. Rucker, AL, is to get the most current doctrine to the field as expeditiously as possible. To accomplish this goal, field circulars are being used to the maximum extent possible, and the Aviation Center has been converting to state-of-the-art, computer-based print technology (Project UPDATE).

The Aviation Center is the first to publish field manuals under Project UPDATE. The reader opinion cards indicate these new UPDATE publications are indeed "the right stuff." Your concerns about the durability of the paper caused The Adjutant General's Office to upgrade the quality of the paper for future UPDATE publications. Take the time to fill out and submit your reader opinion card; it's your vote—use it.

Seven doctrinal field circulars (FCs) are scheduled for production prior to July 1985. These FCs will serve three purposes:

- To provide the most current doctrine that will be used as an interim measure until the field manual is produced.
- To be used as coordinating drafts for the field manuals.
- To serve as a vehicle to validate doctrine and training practices.

Ft. Rucker will stock limited quantities of all proponent field circulars. If your unit is in need of a field circular, submit your request through command channels to: Commander, U.S. Army Aviation Center and Fort Rucker, ATTN: ATZQ-SS-TS Fort Rucker, AL 36362-5000.

DON'T SHOOT!

Several sharp-eyed soldiers have written in about the error in the August 1984 edition of FM 1-402, the "Aviator's Recognition Manual." For those of you that haven't picked up on it, disregard the illustration on the bottom of page 3-45. The photo *incorrectly* depicts an allied M-901, Improved Tow Vehicle as a Warsaw Pact SA-13.

Soon to be published:

FM 1-102, "Army Aviation in an NBC Environment," and **FM 1-104, "Forward Arming and Refueling Points,"** expected to be published by the end of June 1985 as UPDATE publications.

FM 1-140, "Attack Helicopter Gunnery," is scheduled for publication as a field circular in March 1985.

FM 1-300, "Flight Operations and Airfield Management," is under revision and a coordinating draft is expected in March 1985. An additional chapter is planned to address nonaviator flight records.

A series of manuals that address the employment of Aviation units:

FM 1-111, "Combat Aviation Brigade," FM 1-112, "Attack Helicopter Battalion," and **FM 1-113, "Combat Aviation Battalion and Combat Aviation Battalion (GS),"** are scheduled to be produced as field circulars by the end of March 1985.

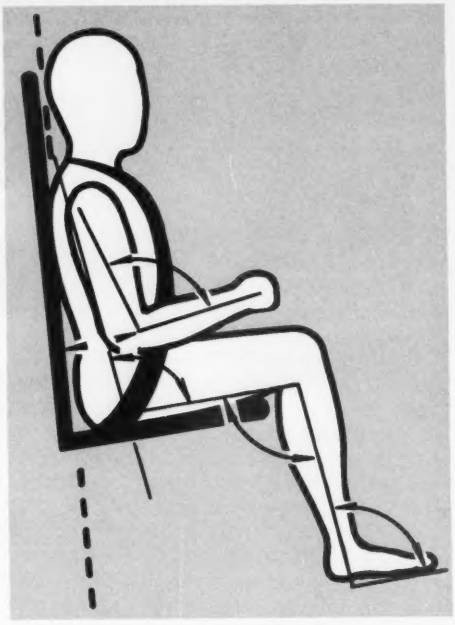
FM 1-114, "Regimental Combat Aviation Squadron," is slated for circulation as a field circular with a cover date of January 1985.

FM 1-116, "Air Cavalry Troop," should be available as a field circular by the end of June 1985.

MONTHLY WRITING AWARD

Back Pain in the Army Helicopter Pilot

U.S. ARMY SAFETY CENTER



Major Dennis F. Shanahan, M.D., SFS
Flight Surgeon, U.S. Army Safety Center
Fort Rucker, Alabama

EARLY IN THE history of helicopter flight, it became apparent that helicopter flightcrews complained of a remarkably high incidence of back pain compared to their fixed wing counterparts. Over the past 25 years, the high incidence of back pain in helicopter flightcrews has been documented in numerous reports. Most of these studies have reported prevalence rates in excess of 50 percent and many have reported prevalences exceeding 75 percent; apparently depending on the group studied. Based on this data, it has become clear that there are certain factors unique to helicopter flight operations that induce a high rate of back pain in crewmembers. This article discusses the typical pain syndrome reported by helicopter crewmembers, factors influencing this condition, and possible causes of the back pain reported. Recommendations for prevention and treatment are also discussed.

Incidence and symptoms

In a survey of 802 U.S. Army aviators, 72.8 percent reported having experienced one or more episodes of back discomfort while flying helicopters over the preceding 2 years. There was a wide variation in reported frequency of symptoms (fig. 1). This variation may be explained by the fact that data show there is a minimum duration exposure to helicopter flight before back pain is experienced. For the subjects surveyed the average exposure time before onset of pain was 88 minutes. Since many helicopter missions do not exceed this minimum threshold, pilots will not necessarily suffer back discomfort on every flight. There is also some in-

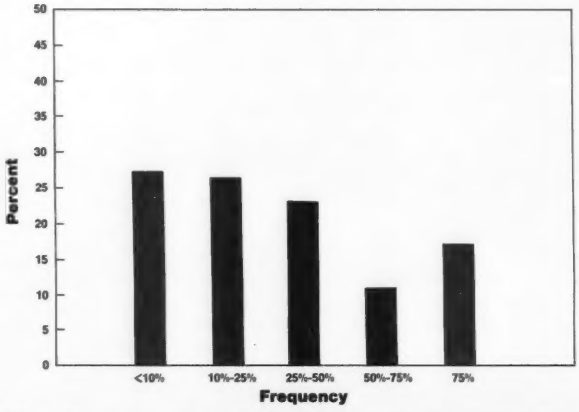


FIGURE 1: Frequency of missions causing back discomfort based on a survey of 802 U.S. Army aviators.

dication that the difficulty and intensity of the mission influence the onset of symptoms.

In the U.S. Army survey, 70 percent of the respondents reported that they most frequently experienced pain in the lower back and 16.6 percent complained most frequently of pain in their buttocks. Relatively few aviators reported symptoms in other regions of the back or neck and radiation into the lower extremities is rare. Once pain begins it may continue to increase in intensity throughout the flight or it may reach a certain intensity and then remain stable. Changing positions or relinquishing the controls does not relieve the pain. These aviators did not notice relief until the flight was over. Some aviators reported that they can delay the onset of discomfort by placing a rolled-up jacket or inflatable cushion in the small of their backs to provide lumbar support.

Aviators participating in the Army survey were asked to rate the intensity of the discomfort they experienced. The intensity of the reported pain can be generally classified as mild to moderate. Although the reported intensity of the pain was not severe, it was significant enough that 28.4 percent of the aviators admitted to rushing through missions because of back pain and 7.5 stated that they had refused missions because of it. It is clear that back pain is a significant problem for Army helicopter pilots and that it has an adverse effect on operational readiness of aircrews.

A majority of Army aviators surveyed reported that their symptoms began to improve immediately after the flight was terminated, and 53 percent stated that they were completely painfree within 12 hours. However, 14.5 percent reported their symptoms persisted for longer than 48 hours, and 8 percent said their symptoms may last longer than 4 days. It may be possible to separate the afflicted crewmembers into two groups—those with transient symptoms (less than 24 hours) and those with persistent symptoms (more than 48 hours). Further study will have to be done before it can be determined whether the aviators with persistent symptoms progressed to their present state as the result of repeated exposure to helicopter flight and if the transient group is likely to progress to a similar state with continued exposure.

Causes

Although the lifetime incidence of low back pain in industrialized societies has been reported to be between 60 and 80 percent, prevalence rates rarely exceed 35 percent. Clearly, the 73 percent prevalence reported by U.S. Army pilots represents a dramatic departure from the general population. Most nonaviators report experiencing acute intermittent episodes of back pain. The length of time the symptoms last varies and years may go by when they have no episodes of pain. The activity or event that triggers a new episode frequently cannot be identified or anticipated. The back pain reported by Army aviators shows a rather clear pattern of onset and symptoms. It is evident that there is some factor or combination of factors associated with helicopter flight that produce a high prevalence of back pain that is rather predictable in character.

The two factors most widely implicated in the causes of back pain in helicopter crewmembers are poor posture and exposure to vibration. Posture as a contributing factor has been established but there is still considerable controversy concerning the role of vibration in the problem.

Posture

The posture that helicopter pilots must assume to fly is considerably different from that required to fly fixed wing aircraft. Helicopters require simultaneous input from all four extremities in order to maintain full control over the aircraft, and the types of missions flown seldom allow for relaxation from the controls. Furthermore, the seat and control configuration in most helicopters forces the pilot to assume an asymmetrical posture. It has been well documented that this control configuration forces pilots to bend forward in their seats and lean slightly to the left. This position does not permit relaxation of the spinal musculature and is a major source of discomfort for helicopter pilots.

It is reasonable to conclude from available data that the posture that helicopter pilots are obliged to maintain for extended periods is a major causal factor in the high prevalence of back pain noted in this population. Furthermore, the rapid resolution of symptoms for the majority of afflicted pilots upon termination of the provoking flight, suggests that their symptoms are related to muscle spasm or other transient mechanical factors rather than permanent pathological conditions.

Vibration

It remains uncertain what the pathological effects of chronic, intermittent exposure to vibration of the frequency and amplitude experienced in Army aircraft may be over the short and long term.

Researchers have recently reported the results of a preliminary study that may help shed some light on the relationship of helicopter-similar vibration to the production of the acute back symptoms that helicopter pilots describe. In this study 11 pilots who reported that they usually experience back discomfort within 2 hours of flight in a UH-1H were placed in a UH-1H seat and control simulator that was mounted to a three-axis vibration table (fig. 2). The cyclic control of the simulator was wired so as to act as the control for a television computer game. The subjects wore standard U.S. Army flight clothing including flight helmet, and they also used standard restraint equipment. They were instructed to position themselves as they would in an actual helicopter and to keep all extremities on the controls at all times except that they were allowed to remove their left hands from the collective for brief

FIGURE 2: Right side view of pilot in UH-1H mock-up.

intervals as in actual flight.

Each pilot was subjected to two 2-hour test periods—one with simulated helicopter vibration and one without. During the test period, the subject played computer games to keep himself occupied at roughly the same concentration level as would be required to fly a helicopter. Pilots verbally reported the onset of back discomfort, and the time into the test was noted. At the completion of the test, each aviator answered a brief questionnaire relating to the nature of his symptoms. Pain intensity was subjectively measured by a visual analog scale.

The experimental conditions produced back pain in all 11 subjects which they described as identical to the pain they typically experience while flying helicopters. Furthermore, there was no significant difference in the time of onset or the intensity of pain for the vibration and no vibration test conditions. The authors concluded that vibration appeared to play little if any role in the acute symptoms these subjects experienced. Of course, this work is only preliminary and will require further validation, but the conclusions have definite implications for prevention of this ailment.

Prevention and treatment

As has been discussed, the primary causal factor in the acute back symptoms that most helicopter pilots report is probably posture. These symptoms may or may not be aggravated by the addition of low frequency vibration in the range of the resonant frequency of the spinal system. Therefore, the key to reducing the incidence of the acute ailment is to improve the seat and control configuration in helicopters to allow crewmembers to maintain better posture.

To build a cockpit that will permit the recommended postural relationships for all aviators will require a substantial departure from current design standards. The gunner/copilot position in the AH-1 Cobra helicopter comes close to achieving the type of support needed (fig. 3). The AH-1 has side-mounted controls for the cyclic and collective which allow the gunner/copilot to operate the helicopter without bending forward or laterally (fig. 4). He may lean back against the back of the seat and his forearms are well supported on foam pads. The controls are operated by pressure from the hands, wrists and forearms.

Short of redesign of the helicopter cockpit, what can be done to prevent back pain in helicopter aircrews? Researchers have stressed good physical condition and spinal strengthening exercises. They also recommend screening of aviators to preclude entry of those individuals with spinal anomalies who are at greater risk of developing problems when exposed to helicopter flight.

Measures that crewmembers may take to delay or prevent the onset of back pain symptoms, or to lessen their severity, include:

- Placing a firm cushion in the lumbar region to provide support to the back. (This does not mean that it replaces the requirement for crashworthiness construction of the seats.) Care must be taken to ensure that the cushion does not blow out of the aircraft and hit the tail rotor, controls, etc.
- Walking for short distances or performing simple flexion and extension exercises during breaks between flights.
- Waiting in the aircraft or sitting during short stops should be discouraged. There may be some advantage also to limiting the time on the controls by alternating with the

FIGURE 3: Pilot in gunner/copilot position of AH-1S Cobra. Arms are supported by rests and back is supported by seat back.

copilot in 15- to 30-minute intervals rather than by alternating piloting duties by flight leg.

Aircrewmembers who are severely afflicted with back pain should be removed from flight duties as long as they continue to have symptoms and flight surgeons need to ensure that they are not placed at desk jobs during their recovery. In most cases, this will require hospitalization or suspension from all duties.

When symptom-free, the patient should be returned to nonflying duties for a period while maintaining a program of physical therapy. If no symptoms recur, the aviator may be returned to flying duties and instructed to follow the recommendations for prevention of back pain discussed above. Permanent suspension from flying duties should be considered if a severe and persistent relapse of symptoms is subsequently experienced.

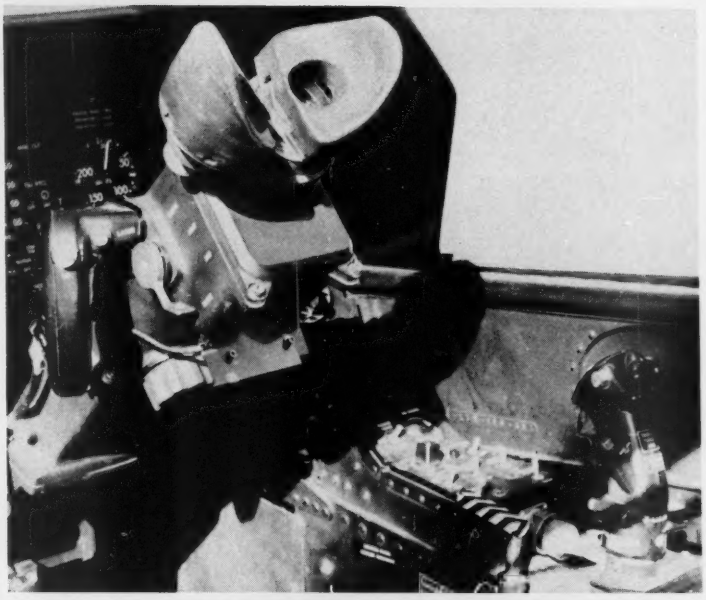


FIGURE 4: Gunner/copilot position in AH-1S Cobra helicopter. Note side-mounted position of cyclic (right) and collective (left) controls.

About the Author

Major Dennis F. Shanahan, M.D., Senior Flight Surgeon, graduated from Middlebury College in Vermont in 1971 with a B.A. degree in chemistry. He received his M.D. from Washington University in 1976.

Major Shanahan served his internship in general surgery at Tripler Army Medical Center in Hawaii and completed 1½ years of a general surgery residency there in 1978.

From 1979 to 1983 he was Chief, Crew Injury and Epidemiology Group, U.S. Army Aeromedical Research Laboratory, Fort Rucker, AL. In July of 1983 he was assigned as Flight Surgeon, U.S. Army Safety Center. During these assignments he has conducted extensive research into the mechanisms of injury in helicopter crashes through field investigation and laboratory experiments. He has been instrumental in the development of new aviation helmet standards and in seeking improved crashworthiness for Army helicopters. Major Shanahan is considered an authority on crash injury and has taught extensively, both in the United States and abroad. He is the author of numerous scientific publications.

Major Shanahan is a graduate of the U.S. Navy Basic Flight Surgeons Course and the U.S. Army Basic Flight Surgeons Course. He has also completed the Crash Survival Investigators Course and the Advanced Crash Survival Investigators Course where he now serves as an instructor.

Major Shanahan has more than 2100 hours of flight time and he holds commercial pilot, CFI, instrument and multiengine ratings. He has been awarded the U.S. Army Meritorious Service Medal and the U.S. Navy Surgeon General's Award.

PEARL'S

Personal Equipment And Rescue/survival Lowdown

Willie Maude Leake photo by Reflections Studio

Rescue Seat, Forest Penetration

Effective immediately, all unserviceable rescue seats, forest penetration, NSN 4240-00-199-7353, are to be returned by the users to Lexington Blue Grass Depot Activity (RIC BL6), Lexington, KY 40511, for repair or condemnation. Disposal is not permitted below depot level. Point of contact is Virginia Farwig, HQ, AVSCOM, AMSAV-SAIA, 4300 Goodfellow Blvd., St. Louis, MO 63120-1798, AUTOVON 693-3809 or Commercial (314) 263-3809.

Foliage Penetrating Flares (KIT) (NSN 1370-00-490-7362 L119)

It has come to our attention that some substitutions have been made when ordering the foliage penetrating flare kit. The kit NSN as above is the only signal flare *kit* authorized for Army use in the SRU-21/P and OV-1/RV-1 survival vests. When ordering this item you should use the "no substitution" Code 1J, 2B or 2 J. See AR 725-50 for the code that best suits your purposes. SC 8465-90-CL-PO2 dated July 1978 is the supply catalog covering the vest. It gives only one stock number for subject kit and no other is authorized.

Address Listing for QDRs and RODs

I refer you to the August 1984 PEARL'S article, subject as above. Because of the ongoing reorganizations and redesignation of names and office symbols the addresses for Quality Deficiency Reports (QDRs) and Reports of Discrepancy (RODs) are shown at right.

If you have a question about personal equipment or rescue/survival gear, write PEARL, AMC Project Officer, ATTN: AMCPO-ALSE; 4300 Goodfellow Blvd., St. Louis, MO 63120-1798 or call AUTOVON 693-1218/9 or Commercial 314-263-1218/9.

☐ **Restraint Equipment**
☐ **Ejection Seats**
☐ **Oxygen Equipment**

Commander
HQ, AVSCOM
ATTN: AMSAV-MPSD
4300 Goodfellow Blvd
St. Louis, MO 63120-1798

☐ **Survival Kits/Vests**
☐ **SPH-4 Helmet**
☐ **Emergency Parachutes and Accessories**
☐ **Flotation Equipment**
☐ **Flight Clothing, Aircrew Boots**
☐ **Chemical Clothing and Accessories**

Commander
HQ, TROSCOM
ATTN: AMSTR-QPF
4300 Goodfellow Blvd
St. Louis, MO 63120-1798

☐ **M-24 Protective Mask**

Commander
AMCCOM(R)
ATTN: AMSMC-QAW-P
Rock Island, IL 61299-6000

☐ **Pyrotechnics**
☐ **Foliage Penetrating Flares**
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Rock Island, IL 61299-6000

☐ **Night Vision Goggles/Equipment**

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Night Vision and Electro Optics Laboratories
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☐ **AN/PRC-90 Survival Radio**
☐ **RT-10 Survival Radio**
☐ **TS-24 Radio Tester and Other Radio Testers**
☐ **Radio Inspection Equipment**

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Communications Electronics Command
ATTN: AMSEL-ME-MQ
Ft. Monmouth, NJ 07703-5017

☐ **AH-64 Helmet**

Program Manager
Advanced Attack Helicopter
ATTN: AMCPM-AH64-SE
4300 Goodfellow Blvd
St. Louis, MO 63120-1798

Information copies of QDRs and RODs should be furnished to:

AMC Project Officer for ALSE
ATTN: AMCPO-ALSE
4300 Goodfellow Blvd
St. Louis, MO 63120-1798
AUTOVON 693-1218
FTS 273-1218

Commander
U.S. Army Aviation Center
ATTN: ATZQ-D-MS
Ft. Rucker, AL 36362-5000
AUTOVON 558-5272
FTS 533-5272

Commandant
U.S. Army Transportation and Aviation
Logistics Schools
ATTN: ATSQ-TDS-M (ALSE)
Ft. Eustis, VA 23604-5361
AUTOVON 927-2475

Commander
U.S. Army Safety Center
ATTN: PESC-PR
Ft. Rucker, AL 36362-5000
AUTOVON 558-2947/3759/6510
FTS 533-2947/3759/6510

Directorate of Evaluation/Standardization

REPORT TO THE FIELD

Changes to Instrument Flight Evaluations—Why?

DEPARTMENT of the Army (DA) Form 954, 1 October 1960, was the Army standard instrument card and was in the possession of most aviators a few years ago. Aviators with 50 hours weather time could put a green special instrument card (DA Form 954-1) in their billfolds and carry it around for years just waiting for someone to challenge the number "1" instrument qualification entry on a flight plan. Some helicopter drivers had pink tactical instrument cards that proved they had flown a TH-13T Sioux while attending initial entry training at Ft. Rucker, AL. In the mid-1970's Army Regulation (AR) 95-63, "U.S. Army Aviation Standardization and Instrument Program," was revised to eliminate all instrument cards. All of these are collectors' items now because someone finally realized that they served no practical purpose.

Some other words, rules and procedures no longer exist for the same reason. For example, instrument "requalification," "reestablishment," "expiration" and "examination" do not appear in AR 95-1.

When AR 95-1 was undergoing revision in 1982, an attempt was made to apply the same rules to instrument flight evaluations. After all, both evaluations are parts of the same annual aviator proficiency and readiness test (AAPART). Aviator "contact" qualification had no expiration, nor were the words "requalification" or "reestablishment" ever applied to the standardization flight evaluation. Once an aviator is qualified in an aircraft he/she is always qualified; not always proficient, but always qualified. Similarly, once instrument qualified an aviator is always qualified. The AAPART verifies proficiency. This change in the regulation, followed by revisions to aircrew training manuals (ATMs), simply means that an aviator must be evaluated at least once annually on his/her ability to perform contact and instrument tasks specified in ATMs. No cards, tickets, certificates or other awards are issued to the aviator attesting to the successful completion of evaluations. Entries on training and flight records are made to serve that purpose.

Change 2, AR 95-1, restricted the use of "noncompatible" synthetic flight training systems (SFTS) for instrument flight evaluations. This change was made in an effort to ensure that aviators have the ability to safely fly their primary aircraft in an instrument environment. It means that an aviator whose primary aircraft is the OH-58 Kiowa cannot be evaluated in an SFTS. Similarly, AH-1 Cobra, UH-60 Black Hawk, CH-47 Chinook and OH-6 Osage aviators also must be evaluated in the aircraft when a compatible SFTS is not available.

How is an instrument flight examiner to administer an instrument flight evaluation in an OH-58 on federal airways and execute a very high frequency omnidirectional range or an instrument landing system approach? He or she doesn't because it is not required. Paragraph 3-30b, AR 95-1, tells us that, "The evaluation will be conducted per the appropriate ATM," meaning that a minimum of two approaches are required. This can be accomplished in an OH-58 by flying nondirectional radio beacon (NDB) and precision approach radar (PAR). A variety of facilities can be used for NDB approaches to include tactical beacons and commercial radio stations. The approach procedure used also may be for an airfield in a completely different part of the world and at altitudes that aid in reducing traffic and noise problems around airports. A "talk down" PAR, conducted by the examiner, may be the answer to a problem of nonavailability of a fixed ground controlled approach (GCA) facility or air traffic congestion. Conditions and standards remain the same per task number 1082 of the appropriate ATM.

What about en route navigation and Federal Aviation Administration (FAA) voice procedures for evaluations in OH-58 and AH-1 helicopters? Consider this. These two helicopters have no role to play in an FAA instrument environment and will only fly instrument meteorological condition in an absolute emergency. Therefore, the evaluation should be in the environment in which the emergency is most likely to occur, for example, en route tracking to an NDB using only the voice procedures necessary to return the aircraft safely to visual meteorological conditions.

This does *not* mean that an aviator is no longer required to be trained in the other instrument flight procedures. Continuation training in other procedures should be accomplished in the SFTS. After all, AR 95-1 only changed the evaluation requirements not the mandatory SFTS requirements. In the case of an OH-58, or other aircraft that have no compatible simulator available, hood time flown may be applied to up to 50 percent of the mandatory SFTS requirements.

The emphasis of the current instrument training and evaluation program is to improve each aviator's ability

to fly his/her primary aircraft in instrument conditions in their normal operating environment as safely as possible. To accomplish this, instrument flight evaluation procedures that have long been oriented toward the FAA must be reoriented to accommodate the real world in which Army tactical aircraft are flown. Instrument flight examiners and instructor pilots must place greater emphasis on instrument flight in the environment where the preponderance of the unit's helicopter operations occur.

DES welcomes your inquiries and requests to focus attention on an area of major importance. Write to us at: Commander, U.S. Army Aviation Center, ATTN: ATZQ-ES, Ft. Rucker, AL 36362-5000; or call us at AUTOVON 558-3504, FTS 533-3504 or Commercial 205-255-3504. After duty hours call Ft. Rucker Hotline, AUTOVON 558-6487 or 205-255-6487 and leave a message.

GOAL — $2,500,000

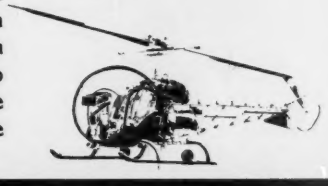
JANUARY 1984 — $1,475,000 cash and pledges

Army Aviation MUSEUM

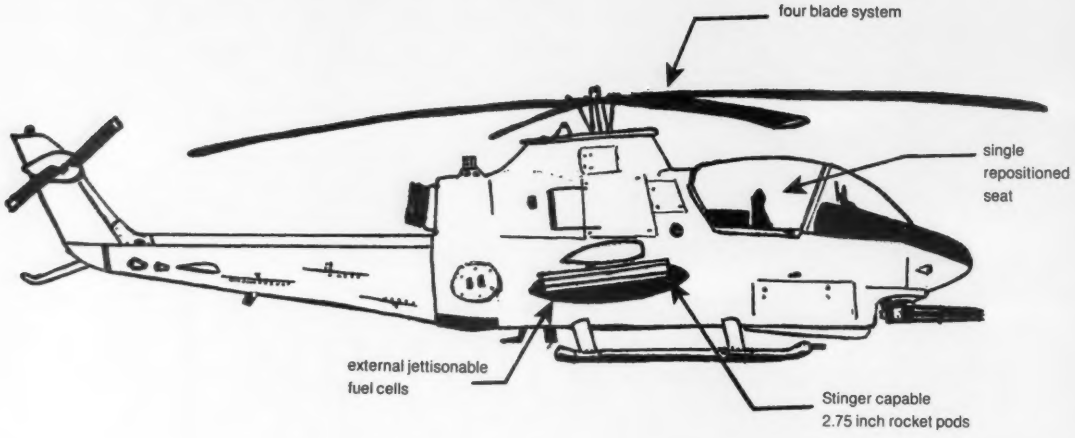
This is a series about the Army Aviation Museum Foundation fund drive. Currently, plans call for building a modern complex to house your Army Aviation Museum. Since last month $2,500 in donations have been received. However, we still have a ways to go, as the barometer above shows. If you would like to help "build" the Army Aviation Museum's new home, you are invited to send a tax deductible contribution to: The Army Aviation Museum Foundation, Box H, Ft. Rucker, AL 36362-5000. If you desire additional information call Mr. Ed Brown at (205) 598-2508.

A Look at What's In Your Museum

The H-13, sometimes referred to as Angel of Mercy, was first flown in Korea at Ascom City in the winter of 1950. Used primarily for medical evacuations, observation and utility duty, the H-13 performed extensively in Korea and in 1951 established a Korean medical evacuation record while flying with the 2d Helicopter Detachment. Continuing its record breaking history, in 1952 the H-13 also set a new record for evacuating casualties from the Chorwan Area for an observation type helicopter. In 1962, the designation of OH-13 was adopted to signify observation type. The H-13B presently on display was transferred from the Army Aviation School to the Museum in 1958 and is the 32d model delivered from the contract of 65 ordered.



Converting the AH-1 for the Air-to-Air Role



CW2 Ron Moring
8th Aviation Battalion
APO New York

DURING THE Vietnam War, the Soviets took quite an interest in U.S. helicopter operations. Since that time, they have been ambitiously developing their own helicopters. It seems that their primary goal is to counteract our helicopter antiarmor mission.

Rather than develop another aircraft to defeat the Soviet helicopter threat, I suggest the modification of an "on-the-shelf" airframe for the air-to-air role. That system is the AH-1 Cobra, which I feel would be a formidable opponent for any Soviet helicopter.

The information in this article represents the opinion of the author and does not necessarily reflect any current or planned policies of the Department of Defense or any of its agencies.

Drive Train Modifications

The T53-L-703 engine is a sufficient powerplant in its present state. Its primary limit is the power that the transmission can handle. Strengthening the transmission, however, would be quite costly and lead to required strengthening of the tail rotor gear boxes and airframe. Since the engine is sufficient and the transmission is the limitation, trimming the aircraft's weight (which would happen with removal of the TOW missile system and copilot) would be a much easier solution.

Another good modification would be a mechanical environmental control system (ECS). This would greatly reduce the engine's operating temperature during ECS use and it would afford the pilot more of the engine's power in extreme temperature conditions.

Rotor System Modifications

The Cobra's tail rotor system is well proven and quite dependable. It is quite sufficient without improvement. The main rotor system, however, is unacceptable for an air-to-air role.

Bell Helicopter Textron has designed a new four-blade system which is a good alternative and is about 46 pounds lighter. Additionally, the system has a higher maximum thrust and is negative G-capable.

These modifications would mean a faster aircraft with a greater rate of climb. Additionally, the aircraft would be able to turn in a much smaller radius. All of these qualities are required in the air-to-air role.

Airframe Modifications

The Cobra airframe is a good size and shape for the air-to-air role. The tailboom should be left intact with the exception of possibly converting the flush rivets. This would reduce the drag ratio to some degree.

The main fuselage is also acceptable in the present form. The wings, however, should be cleaned up to reduce drag.

The forward portion of the aircraft would require the greatest modification. The front seat position would be removed and the pilot station moved about 1 foot forward to improve the rearward field of view. Due to an enhanced avionics capability this would not overburden the pilot. Additionally, the canopy should be reverted to the old bubble type, possibly wider, to afford better visibility. The nose section would be changed to the old G model type with the removal of the telescopic sight unit (TSU).

Armament

The armament system of the AH-1 has been specialized for the antiarmor role. In its present state, the Cobra is a potent day antiarmor weapon. Before employment in the air-to-air role, however, there are several modifications that should be made.

The 20 mm is a well-proven system. For it to be useful in an air-to-air role, the rate of fire needs to be increased from 750 rounds per minute to 1,500 rounds per minute. This increased rate of fire is required to put sufficient rounds on an airborne target; it could be established easily with a more powerful gundrive motor—say that of the Vulcan system. The gun would be able to withstand this rate of fire without substantial reduction in the life of the barrel. The helmet sight system allows the pilot to position the gun 110 degrees either side of center and should be retained. This would allow the pilot to fire fixed forward using the heads-up display and to also maneuver the gun for a close in, off center shot. Moreover, a fire control computer for this system would be a good addition.

Although the helmet sight system should be retained, the TOW missile system and TSU are useless in an air-to-air role and should be removed. This would result in a weight savings of about 450 pounds.

The TOW system would be replaced by the Stinger air-to-air missile system. The black boxes could be placed in the copilot's section so that the center of gravity wouldn't be greatly affected and the components would be cooled by the present copilot ECS ducting. Additionally, the removal of the TSU would be compensated for by the removal of the TOW system black boxes and counterbalance weights from the tail boom.

The Stinger missiles themselves could be placed in modified seven-shot pods and used in conjunction with the 2.75 inch rocket system. The inboard stores could then be removed or possibly used for jettisonable external fuel stores. This external fuel system would require only minimal modification because of the room left by removing the hydraulic lines used in conjunction with the TOW missile system.

Employment

The completed system could be used in numbers of two per scout/attack team to provide air security. This would allow the scouts to better perform their mission. The air-to-air Cobra also would be a superior air assault escort because its increased speed would enable it to keep up with the UH-60 Black Hawk. Furthermore, it would have an increased station time in both roles because of its ability to take off fully loaded *and* fueled.

Conclusion

This article represents concepts that I have considered for some time. It seems more feasible to convert an "on-the-shelf system" than to develop new systems or to tax an already overloaded scout. Regardless, one of these alternatives should be chosen and acted upon to counter the Soviet helicopter-to-helicopter threat.

For more information see FM 1-107, "Air-to-Air Combat."

WHY AIR ASSAULT

at the U.S. Army Aviation Center?

Colonel Lynn C. Hooper
Commander, 1st Aviation Brigade
U.S. Army Aviation Center
Fort Rucker, AL

Captain Jeffrey J. Anderson
S3, 1st Aviation Brigade
U.S. Army Aviation Center
Fort Rucker, AL

FOR YEARS the U.S. Army Aviation Center and School at Ft. Rucker, AL, has trained Army Aviation soldiers. Today, we train and branch-qualify Army Aviation soldiers in the areas of combat, combat support or combat service support, all of which are directed toward supporting the soldier on the ground. In turn, Army Aviation's missions are an integral part of the ground commanders' schemes of maneuver. Ground commanders know that the quality of Aviation soldiers being graduated at the Aviation Center is second to none.

Part of the credit for producing these highly trained Aviation soldiers can be traced to the Aviation Center's Air Assault School. The 10-day course teaches soldiers of all ranks the techniques of rappelling, equipment rigging and slingload operations, pathfinder operations and planning execution of air assault (some still use the term airmobile) operations. The course is physically demanding and students participate in forced marches and runs in excess of 81 kilometers or 50 miles during each course.

Air assault training is essential to support the AirLand Battle and the Army of Excellence. If you dissect the word AirLand—we, Army Aviation, are the major tactical air asset and represent the most mobile and lethal combat multiplier in the United States Army. Not only must aviators and the Aviation community be experts in aircraft capabilities, limitations and operation, but they also must be successful as tacticians, leaders and combat asset managers. Army Aviation soldiers must thoroughly understand the missions of Infantry, Armor, Artillery, Air Defense and the Corps of Engineers to effectively fight with, employ and support these branches. We must be *combat soldiers* if we are to successfully meet the challenges of the AirLand Battle.

Ft. Rucker air assault training began when Army Aviation became a full-fledged branch and member of the combined arms team. The concept

photographs by the S3 1st Aviation Brigade

is most applicable at the Aviation Center where enlisted, noncommissioned officers and warrant and commissioned officers alike are trained.

Advanced Individual Training students in the 67V (OH-58 Repairman), 67N (UH-1 Repairman), 93H (Air Traffic Control (ATC) Tower Operator), 93J (ATC Ground Controlled Approach Controller) and 93P (Flight Operations Coordinator) military occupational specialty fields are assigned to the 1st Aviation Brigade's (Air Assault) 4th Aviation Training Battalion. They comprise the frontline Aviation soldiers who will repair aircraft, provide air traffic control and monitor Aviation assets on the future battlefield. Aviation warrant officer candidates and newly commissioned second lieutenants, assigned to the 6th Aviation Training Battalion, will operate and employ those assets in rapidly changing and dynamic scenarios.

Transition to the Army of Excellence requires all Aviation soldiers to have indepth knowledge of Army Aviation tactics and doctrine. Consider the void that exists in the deletion of many pathfinder units from the force structure in the Army of Excellence. The air assault soldier has the requisite skills to set up landing zones (LZs), use proper arm and hand signals and is familiar with proper communications procedures.

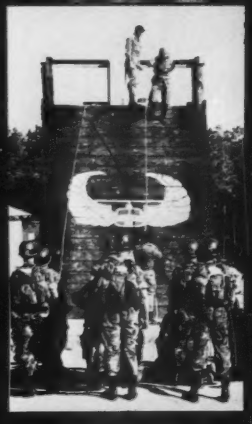
Tactically, air assault missions are planned and executed by all combat arms. The final decisions made with regard to air routes, air check points, enemy situations, chalk orders and timetables rests with the Aviation asset commander. Air assault training at Ft. Rucker familiarizes the students with both ends of the spectrum—air and ground. An appreciation is gained for the ground soldiers' efforts to set up LZs, hook up slingloads and rappel into areas that are not adequate for helicopter landings. Likewise, ground Aviation soldiers get a feel for aircraft operations, capabilities and limitations and gain new confidence in rotary wing aircraft when they actually participate in air assault operations. This team building and cooperative spirit will be brought to the field in the form of air assault soldiers.

A substantial benefit of conducting an air assault school at Ft. Rucker is the real-world training student pilots receive in supporting slingload, air assault and rappel training. Initial entry flight students, under the constant supervision of seasoned instructor pilots, actually fly the

slingload, rappelling and air assault missions in support of the air assault program of instruction. Aviation officer basic course and advanced individual training students participate in air assault operations during the course of their extensive field training exercises. It is these synergistic effects that assist in producing qualified and aware Aviation soldiers, a product that has never been better. The intangible benefits of this training and philosophy are profound. They produce:

- better qualified Aviation soldiers assigned to the field;
- a confidence in Aviation as a branch, a combat arms and a combined arms team member;
- an effect where Aviation and air assault is analogous as is infantry and ranger;
- pride and esprit de corps through team work, challenges and plain hard work;
- self-confidence and a *can do* attitude which improves each soldier's view of himself.

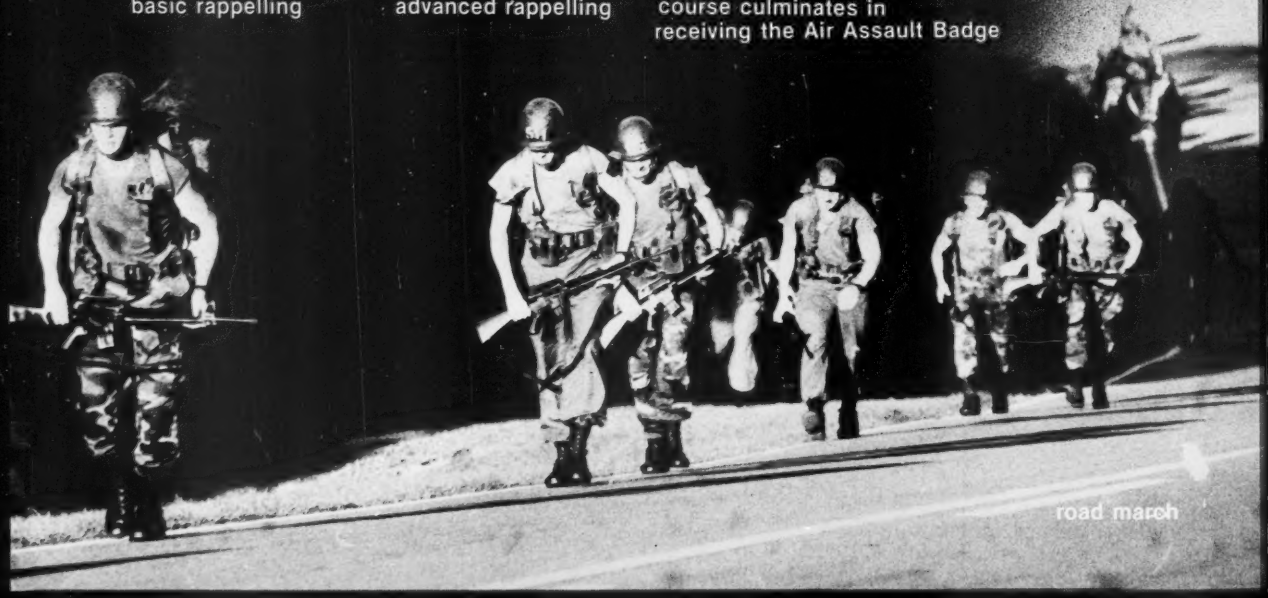
Aviation soldiers are members of a highly mobile force which will employ assets in every phase and physical area of the battle. Air assault training builds expertise, knowledge and confidence which produces more technically and tactically qualified Aviation soldiers. And that spells the difference between success and failure on the AirLand Battlefield. "Air assault, sir!"



basic rappelling

advanced rappelling

course culminates in receiving the Air Assault Badge



road march

Jump TOC For the Air Cavalry Squadron

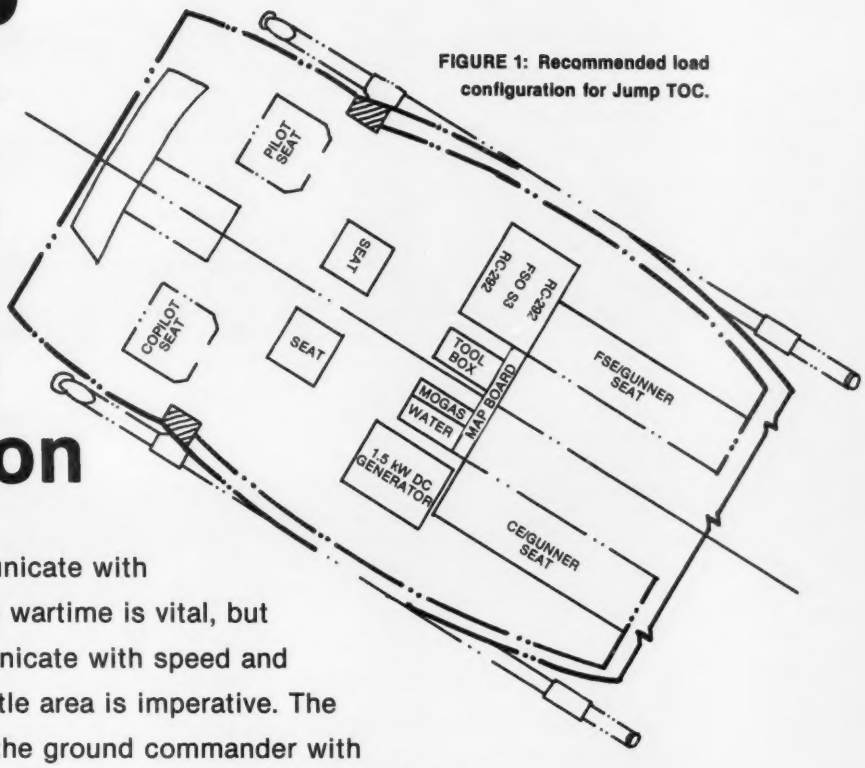


FIGURE 1: Recommended load configuration for Jump TOC.

The ability to communicate with ground forces during wartime is vital, but to be able to communicate with speed and mobility over the battle area is imperative. The 4/9 Cav can provide the ground commander with pertinent information concerning the enemy, terrain and weather, as well as the protection needed against such observations.

Captain Alan D. Swain
and
Captain Richard L. Lucas

When this article was written, CPT Swain was S-3 and CPT Lucas, Assistant S-3 of the 41st Squadron (Air), 9th Cavalry, 6th Cavalry Brigade (Air Combat), Ft. Hood, TX.

ARMY AVIATION will fight the AirLand Battle as a member of the Combined Arms Team. Support of the ground commander's tactical scheme of maneuver in a timely manner is imperative. The unique advantage Aviation affords with its speed and mobility may well be the key to a successful operation. Command and control (C^2) of forward Aviation assets is most important. The March 1979 *Aviation Digest* article titled, "A Tactical Command Post for Use in the Command and Control of Forward Aviation Assets," written by Major James J. Rudy, addressed a C^2 concept used by his unit. MAJ Rudy, while an attack helicopter company commander in Europe, recognized the difficulty of controlling forward Aviation assets and developed a tactical command post for C^2.

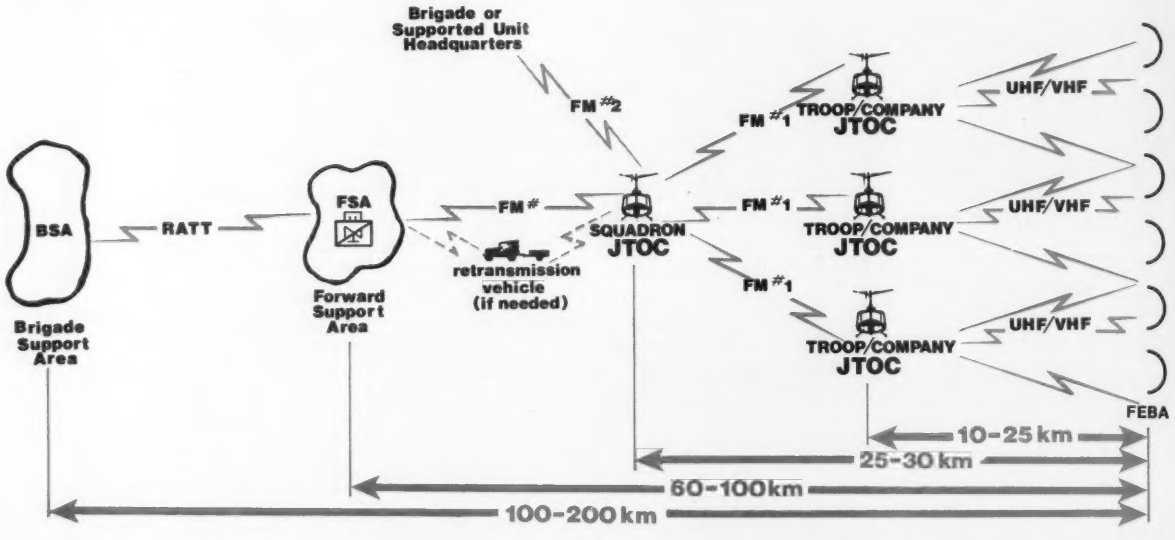
In the 4th Squadron (Air), 9th Cavalry, 6th Cavalry Brigade (Air Combat), the C^2 concept is used in a similar manner to provide that timely support to the ground maneuver

commander. The mission of the Air Cavalry is to perform reconnaissance, security and surveillance; to provide real-time information concerning the enemy, terrain and weather throughout the battle area; and to alert or provide protection agains enemy observation or attack. The 4/9th Cavalry Squadron is composed of a large number of aerial gun platforms which provide armor-defeating power to the ground commander. It is capable of moving rapidly about the modern battlefield to bring firepower to bear on tanks and other armored vehicles. The unit's speed, mobility and maneuverability enable it to traverse great distances, use terrain for concealment, mass antiarmor firepower at the critical time and place, and exploit the enemy's weaknesses. The 6th Cavalry Brigade (AC) organizes the available squadrons into task forces (TFs). The 4/9th Cavalry Sqaudron may detach an air cavalry troop and attach an attack helicopter company. This results in like configured TFs in the brigade and permits each TF to accomplish the dual mission and capability of finding and destroying its adversaries.

The unit's tactical employment plans require it to operate over long distances. The squadron's tactical operations center (TOC) and logistical support (Classes III and V) are located from 60 to 100 km behind the forward edge of the battle area (FEBA) in the squadron forward support area (FSA). Operating over such long distances places a strain on the C^2 of operations. Effective communications are essential for positive C^2 of tactical elements by the squadron headquarters. The 4/9th Cavalry uses the "Jump-TOC" (JTOC) concept to exercise C^2. All the equipment used in the JTOC is authorized under the current Modification Table of Organization and Equipment. The JTOC concept has been used by the squadron for many years. Improvements and refinements of the JTOC operation and its configuration have been made since its introduction several years ago. The following is a brief description of the squadron's present JTOC operation and configuration.

A UH-1H Huey helicopter equipped with dual frequency modulated (FM) capability is used for the JTOC. Additional equipment required for the JTOC includes: a 1.5 kW 28v direct current (DC) generator with two 5-gallon cans for

FIGURE 2: Brigade employment distances and lines of communications.



fuel; two Radio Code (RC)-292 or OE-254 antennas; and a map-board of the area of operations (positioned against the front of the transmission bulkhead). The command console (AN/ASC-15) is not used due to its excessive weight (about 500 pounds). Use of the AN/ASC-15 would limit helicopter employment in high density altitude and high temperature environments. By not using the command console, more space is available in the crew compartment for JTOC operations. The JTOC crew is limited to the S3, the fire support officer (FSO), the S2, the UH-1 pilot, the fire support noncommissioned officer (FSNCO) and the crewchief. Personal gear is limited to one rucksack per individual because of space limitations. (Figure 1 depicts a recommended load configuration for JTOC operations.)

The JTOC positions itself on relatively high ground anywhere from 25 to 30 km from the FEBA

FIGURE 3: FM number 1 radio antenna connection.

Disconnect the radio lead (connector P3301) from the FM number 1 radio antenna; located at station 83 in the UH-1 ceiling, behind the sound-proofing. Attach the RC-292 with adaptor connector (NSN 5935-00-149-3914) to the FM number 1 radio lead (connector P3301).

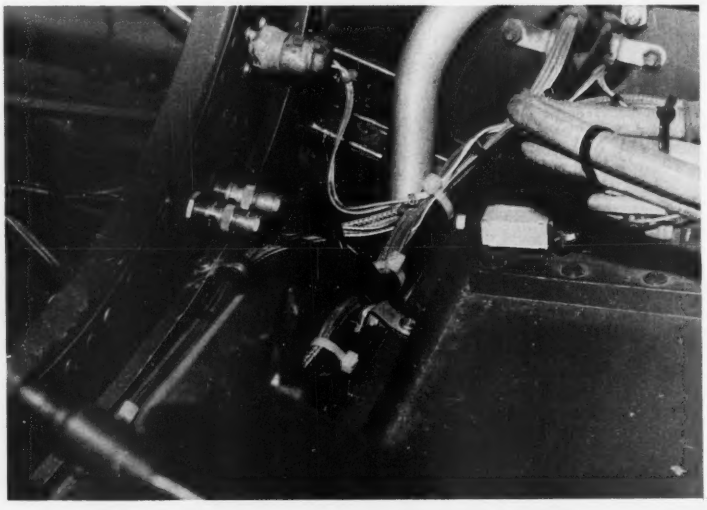
(beyond the range of enemy artillery). It selects a position from which it can communicate with its troops/companies and with the squadron TOC in the FSA. The squadron commander with his aircraft positions himself near the JTOC. His UH-1, equipped in the same configuration as the JTOC aircraft, is the squadron's alternate command post. If terrain or distance precludes the squadron jump from directly communicating with the main TOC, a retrans vehicle is used. Each troop/company is equipped to operate an aircraft in the JTOC configuration. Primary communication and control of operations is on FM number 1 secure between the main TOC, the squadron jump and the troops/companies. The troops use ultrahigh frequency/very high frequency (UHF/VHF) for C² of their forward elements. In the event FM number 1 is jammed, the squadron switches to UHF/VHF for command and control of forward operations. The FM number 2 radio is available for communicating with brigade or supported unit headquarters. The squadron TOC is updated periodically on operations by the JTOC. Depending on the tactical situation and how fluid the battle is, ground JTOC setup may not be necessary or advisable. The JTOC can control operations in an effective manner while airborne or from a ground position. (Figure 2 on page 32 depicts the distances involved and the squadron's line of communications.)

JTOC setup duties at the selected field site are evenly distributed. The S3 operates the UH-1's radios using battery power while the UH-1 pilot shuts down the aircraft. The S2 and crewchief setup the 1.5 kW generator and the FSO and FSNCO erect the RC-292s. In about 7 minutes the squadron jump is fully operational using 1.5 kW generator power. The antennae (292) are connected to both FM number 1 and 2 radios with an adaptor connector, national stock number (NSN) 5935-00-149-3914. (Figures 3, page 33, and 4 show the antennae connections for the FM number 1 and FM number 2 radios.) The 1.5 kW 28v DC generator with an auxiliary power unit cable (AN 2551E20) connects to the helicopter at the external power receptacle. (Note: During the initial setup of the day, it is recommended that generator power output be checked before connection to the aircraft.) (Caution: Ensure battery switch is in the "OFF" position prior to bringing DC generator power "on-line.") To reduce the power drain on the generator there are a number of DC systems which should be disengaged during ground operations. (Figure 5 shows which circuits should be pulled.) (Note: Inverter power is required only to change UHF/VHF frequencies and should be OFF when not needed.)

The JTOC repositions about every 1½ hours (the approximate time of a generator fuel load) to lessen the potential of enemy discovery of its position because of the large electromagnetic signature the JTOC presents during operation. The troop JTOCs normally operate within range of threat artillery and may have to reposition more often. Teardown of the JTOC before repositioning takes less than 5 minutes. (Emergency displacement can be accomplished in 2 to 3 minutes.) During teardown and aircraft runup an AN/PRC-77, with headset, may be used for continued radio contact with forward elements. Additional equipment which can enhance JTOC operations is an aircraft equipped with an AN/ARC-102 high frequency (HF) radio. The HF radio increases the range of communications, but

FIGURE 4: FM number 2 radio connection.

Disconnect the radio lead (connector P2104) from the FM number 2 radio antenna lead located at station 243.89 in the oil cooler fan compartment. Attach the RC-292 with adaptor connector (NSN 5935-00-149-3914) to the FM number 2 radio lead (connector P2104).



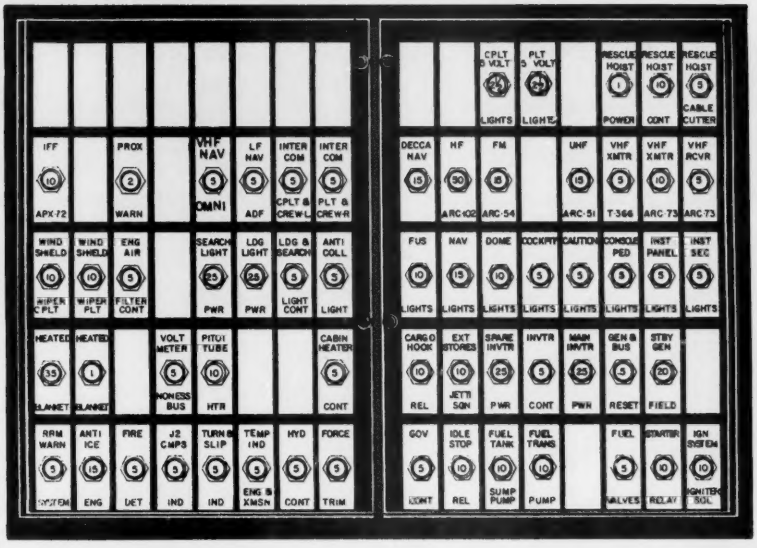


FIGURE 5: DC systems to be pulled "OFF LINE" during JTOC operations.

JTOC OPERATIONS SWITCHES

1. **BAT — OFF**
2. RADIOS—as desired
3. FUEL SWITCHES—OFF
4. ANTICOLLISION/POSITION LIGHTS—OFF
5. PITOT HEAT—OFF
6. INST LIGHTING—as desired
7. INVERTER SWITCH—OFF (except to change frequencies)
8. NON-ESS BUS—NORMAL
9. DC CIRCUIT BREAKERS—OFF (as specified below)
10. CABIN LIGHTS—as desired (N)

DC VOLTMETER: External DC generator should be set to reflect 28v DC on the DC voltmeter, with appropriate radios and equipment ON.

For JTO operations: Pull out the following DC circuit breakers and use a 1.5 kW 28v DC generator connected to the external power receptacle.

1. AIMS Altimeter
2. Caution Panel Lights
3. RPM Warning
4. LH Fuel Boost Pump
5. Turn & Slip Indicator
6. Force Trim
7. RH Fuel Boost Pump

places a strain on the 1.5 kW generator and should be used only when necessary. Also, a canopy cover or poncho should be used to reduce canopy glint and aid in cover and concealment. (Other recommended equipment is addressed in figure 6.)

This JTOC concept has been used throughout the squadron during numerous exercises, and was highly successful during the squadron's April 1983 Army Training and Evaluation Program. This concept has increased the Aviation commanders' positive C^2 of their forward Aviation assets and vastly improved the unit's responsiveness and support to the ground commander as part of the Combined Arms Team.

FIGURE 6: JTOC equipment list.

REQUIRED EQUIPMENT		
NOMENCLATURE	**NSN**	**QUANTITY**
UH-1H	1520-00-087-7637	1
GEN ST MEP 025A (1.5 kW 28vDC)	6115-00-017-8236	1
APU Cable	AN 2551E20	1
Grounding Rod	5975-00-878-3791	1
Adaptor, Connector	5935-00-149-3914	2
AN/RC-292	5985-00-497-8554	2
Fuel Can, 5 Gal		2
Map Board		1
JTOC Box (supplies, report forms, etc.)		1
ADDITIONAL EQUIPMENT		
NOMENCLATURE	**NSN**	**QUANTITY**
AN/PRC 77	5820-00-930-3724	1
Headset	5965-00-226-2915	4
"Y" Cord		2
Sound proof paneling (for use around generator)		2

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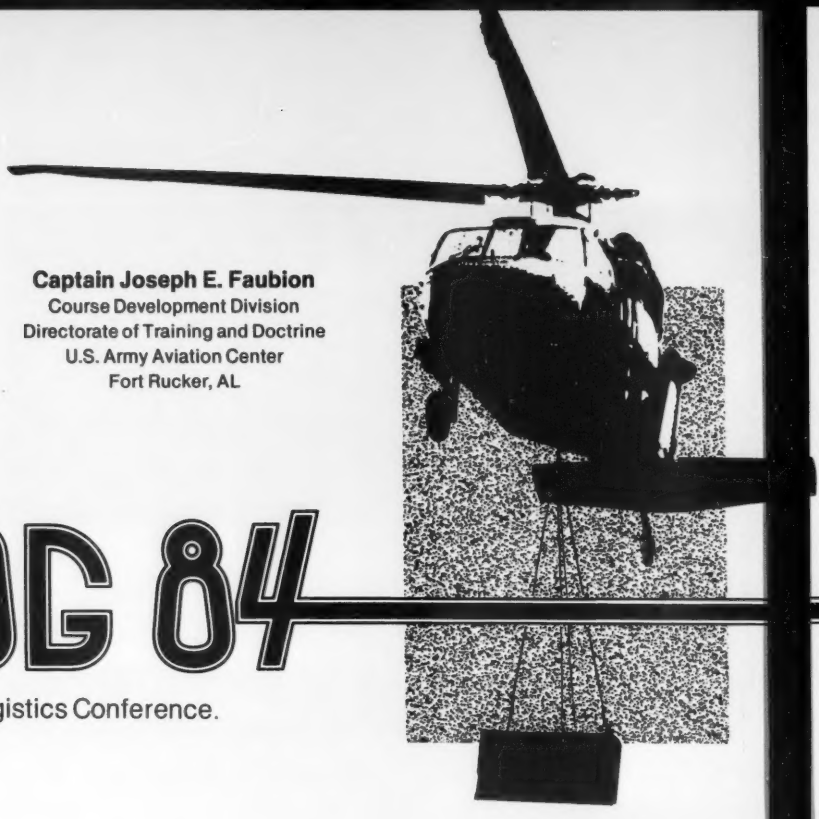


AVLOG 84

The first Aviation Logistics Conference.

ANOTHER MILESTONE was achieved by the Aviation community when MG Bobby J. Maddox and MG Aaron L. Lilley Jr. presented their closing remarks to the attendees of the 1984 Aviation Logistics Conference (AVLOG-84) at Ft. Rucker. The conference was cohosted by the U.S. Army Aviation Center, Ft. Rucker, AL, commanded by MG Maddox, and the U.S. Army Aviation Logistics School, Ft. Eustis, VA, commanded by MG Lilley. The conference, from 15 to 17 August 1984, was the first time Aviation field commanders, nonrated commanders and logisticians—including the Department of the Army (DA) Deputy Chief of Staff for Logistics and the Aviation Logistics Center commander—were brought together in a general officer forum to discuss Aviation logistics exclusively.

The need for a separate Aviation logistics conference was recognized during the October 1983 Aviation Employment Conference (AVNEC-83) (reported in the January 1984 *Aviation Digest,* page 2) in light of the rapid improvements and capabilities of Aviation in flexibility, mobility and the ability to act within the enemy's decision cycle. These improvements dictated that logistical support and doctrine be developed so as not to restrict the employment of Aviation assets on the AirLand Battlefield.

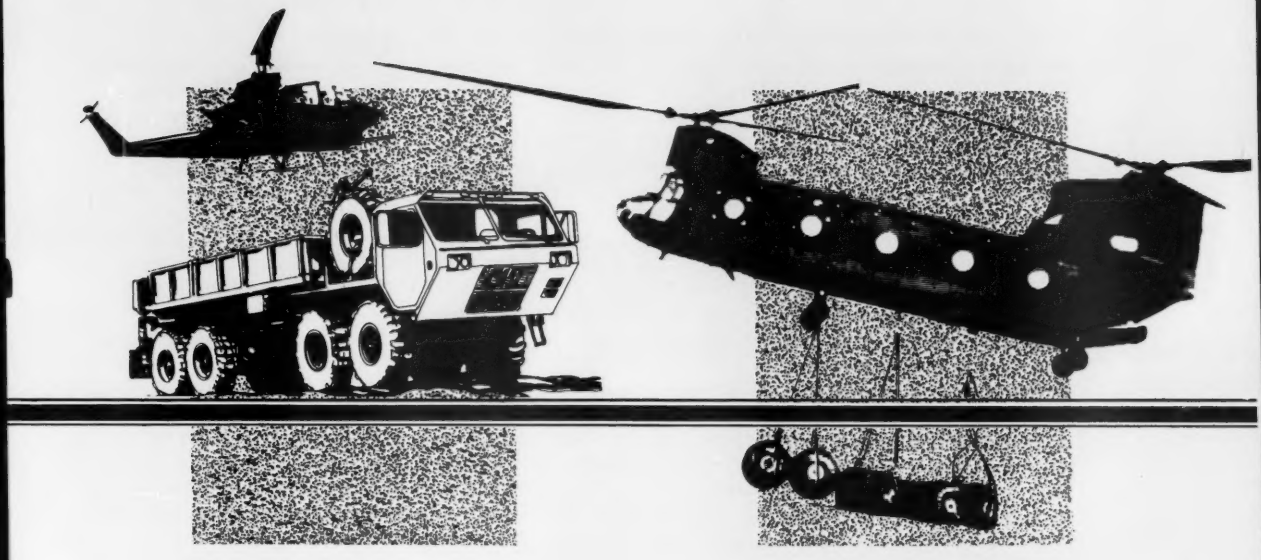
AVLOG Objectives.

The conduct of AVLOG-84 was patterned after AVNEC-83 for continuity and to capitalize on its proven format. The focus of AVLOG was on the Army of Excellence combat Aviation brigade (CAB) in three levels of conflict: high-intensity (Europe), mid-intensity (Southeast Asia) and contingency mission.

The expressed objectives of the conference were to:

- Seek consensus on how to support Army Aviation in the AirLand Battle.
- Incorporate these conclusions into our doctrinal manuals.
- Document any unresolved issues into a viable action plan with attainable goals.

AVLOG-84 served as a capstone conference to resolve issues for which solutions could be



developed in that forum; to recommend further research into the ones that needed it; and, to put to rest issues recognized as being resource constrained and impossible to implement in the near term. By accomplishing this in an open forum of rated and nonrated commanders and logisticians, a unified position was established representing not only the Aviation community but also ground commanders.

AVLOG Issues.

During the early stages of conference planning, a message was sent worldwide to units and activities concerned with Army Aviation announcing AVLOG-84 and soliciting their input for the conference. Comments received from the field were screened by subject matter experts during a working group held at the Aviation Logistics School from 21 through 26 March 1984. In addition to the field responses, issues were also extracted from the following sources:

- Army Aviation Mission Area Analysis (AAMAA).
- Combat Service Support Mission Area Analysis,
- Army Aviation Systems Program Review,
- Logistics System Program Review,
- Army Aviation Functional Area Assessment,
- Cavalry Brigade (Air Attack) Independent Evaluation Report, 9th Infantry Division, October 1982, and
- AVNEC-83.

The Aviation Logistics School working group consolidated the issues into various categories for review and approval by the Aviation supportability committee, which has been established at the Aviation Logistics School and acts as a clearing house for ideas on improving Aviation logistic support. The committee approved the categories which were then structured into the AVLOG consensus document. The consensus document consisted of a series of questions on each issue for which the panels were to seek resolution. The categories of issues discussed during AVLOG-84 were:

- DA approved wartime flying hour rates
- Classes III and V (fuel and ammunition).

- Aircraft combat maintenance and battle damage repair (ACM/BDR),
- Aircraft recovery and evacuation,
- Night maintenance,
- Forward support battalion (FSB),
- Aircraft maintenance company mobility,
- CAB mobility,
- Aviation ground support equipment, test, measurement and diagnostic equipment (TMDE)/intermediate forward test equipment (IFTE) and AH-64 Apache electronic equipment test facility,
- Army air transport,
- Rear area combat operations (RACO) and rear area protection (RAP),
- Classes VII and IX provisioning and distribution (major end items and repair parts and components).

Nature and Scope of the Conference Procedure.

AVLOG-84 participants were provided a thorough overview of Aviation logistics. Included were Aviation force structure, logistics support design in the Army of Excellence, lessons learned in Grenada and the Falkland Islands, total package and unit materiel fielding, and an update on the maximizing daily helicopter flying hours series of studies conducted by the Concepts Analysis Agency (CAA).

Three panels were organized and shown the scenario video tapes from AVNEC-83. The high-intensity scenario was adapted from the U.S. Army Training and Doctrine Command (TRADOC) approved scenario based on a European conflict. The mid-intensity scenario was based on the Mideast III scenario issued for use by TRADOC. The contingency mission scenario was developed by the Scores Branch, Directorate of Combat Developments, at the Army Aviation Center. It was not a derivative of any standard scenario and used a fictitious geographic location, a generic threat and hypothetical U.S. Forces.

Fact sheets providing background information and the current status of the issues were given to each participant. Using this information and the questions posed in the consensus document, the three panels worked to reach agreement on logistical doctrine and techniques to support the CAB.

Common Conclusions.

The results of each panel were presented and discussed on the second day. Consensus from the three panels was then established regarding these conclusion statements.

Summarized below are the background and outcomes on each issue.

DA Approved Wartime Flying Hour Rates.

Background: DA wartime flying hours are the basis for Aviation support and affect logistical support planning in any scenario. The Aviation MAA (April 1982 *Aviation Digest*) identified a need to fly more hours than cited in Army Regulation (AR) 570-2. The AAMAA flying hour rates were determined using the required flight hours by intensity from maintenance, manpower, logistics analysis; losses from the helicopter attrition rate portion of the wartime requirements for ammunition, materiel and personnel fiscal year (FY) 1984 to 1988 (WARRAMP P88E) study; and a theater scenario of intensities by day for 180 days from the CAA. Sustainment packages have been identified to meet the short fall. AAMAA flying hours are currently used by the Aviation Center in the conduct of studies and in the

AIRCRAFT	DA APPROVED HOURS	AAPRSO*	MAA 90-DAY WAR					
			CSAC*	AHB*	CAV*	GSAC*	SEMA*	CORPS
OH-58	2.27	3.70		2.71	4.74	3.21		3.21
AH-64		3.70		3.28	5.53			3.28
UH-1	2.63	4.17				5.93		5.93
UH-60	2.53	5.50	6.11	2.31	2.21		5.00	6.10
CH-47		3.50						1.93
FAAO*	2.27	4.17				6.42		

*AAPRSO: Army Aviation Personnel Requirements for Sustained Operations
*CSAC: combat support Aviation company
*AHB: attack helicopter battalion
*CAV: cavalry
*GSAC: general support Aviation company
*SEMA: special electronics mission aircraft
*FAAO: Field Artillery aerial observer

computation of fuel requirements for force design. A comparison of DA-approved, MAA 90-day war with the Army Aviation personnel requirements for sustained operations (AAPRSO) study of daily flying hours is in the figure at left.

Conclusions:

- Current published wartime flying hour rates (AR 570-2) are too low.
- Aviation MAA proposed wartime flying hour rates are probably not affordable within Army and Aviation resource accounts.
- Required rates have been identified and validated. The DA staff must decide on an affordable rate above those currently published to establish a standard for all logistics and tactical planners within TRADOC and the Army.

Classes III and V.

Background: Classes III and V were described as the Achilles' Heel of Aviation at AVNEC-83. Considerable work has been done in the area of forward arming and refueling points (FARPs) at the Aviation Center and in refueling operations at the Quartermaster School, Ft. Lee, VA. The FARP operational concept is included in TRADOC Pamphlet 525-15, dated 19 March 1982. Additionally, a draft of Field Manual 1-104 on FARPs was sent to the field for review on 1 May 1984. The introduction of the heavy expanded mobility tactical truck and the heavy expanded mobility ammunition trailer are significant ongoing materiel actions to improve FARP operations.

Conclusions:

- The need that exists to improve our ability to emplace and resupply the forward arming and refueling points was underscored.
- The Army must reexamine its capability to store, handle and manage Aviation Classes III and V from introduction into a theater until ultimate consumption, including operation across the forward line of own troops.

Aircraft Combat Maintenance And Battle Damage Repair.

Background: The maintenance system is designed to support the wartime flying hour program outlined in AR 570-2. As stated before, the 1982 AAMAA published a requirement roughly twice that of the DA-approved program. It is essential that damaged aircraft be repaired quickly to meet the higher flying hour requirement predicted by the AAMAA. Peacetime procedures for repair of damage may take weeks and normal scheduled maintenance may unnecessarily prevent the maximum use of limited Aviation assets, even if all required personnel and parts are available. Recent wars in the Mideast have shown that major sytems availability and number of missions completed can be increased significantly through the application of an organized battle damage repair program. Armies of other nations, such as the United Kingdom and Israel, have existing programs and the United States Air Force is rapidly developing the capability.

ACM/BDR provides expeditious aircraft maintenance hardware and software to augment and enhance the Army's ability to maintain aircraft availability during intense combat operations. The system's main characteristics consist of: rapid assessment and inspection techniques, deferrability and serviceability criteria, quick-fix repair and cannibalization procedures. This program is top logistics research and development (R&D) priority at the Aviation Logistics School.

Conclusion:

• ACM/BDR is critical to achieve maximum aircraft availability daily on the battlefield. It should continue to be the number one Aviation logistics R&D program.

Aircraft Recovery And Evacuation.

Background: The concept extending the responsibility to Aviation unit maintenance (AVUM) for rigging their organic aircraft evolved from the Division 86 Study as a method of significantly increasing the recovery potential within the division. It provides additional recovery capability to augment Aviation intermediate maintenance (AVIM) during a high-intensity conflict, prevents duplication of effort with multiple onsite damage inspections (AVUM then AVIM) and should be more responsive. In April 1980 the Chief of Staff of the Army approved the air cavalry attack brigade operational and organizational concept for the light division and directed its implementation in the 9th Infantry Division. At that time the Aviation Logistics School recommended that action be initiated to develop a lightweight tailored aerial recovery kit to meet AVUM requirements.

The unit maintenance aircraft recovery kit (UMARK) was conceived to meet the needs of AVUM units to quickly rig for recovery of their organic helicopters which cannot be repaired on the battlefield or nonflyable helicopters undergoing maintenance which must be moved when units relocate. The second phase is to upgrade the present AVIM aerial recovery kit (ARK) using advanced technology materials to reduce kit weight by 50 percent and also yield adaption to the UH-60 Black Hawk, AH-64 and OH-58D Kiowa. Full-scale engineering development funds are now programed for both the UMARK and improved AVIM ARK starting in FY 86.

Conclusions:

• The doctrine of AVUM rigging is valid and we need to get on with fielding of the unit aircraft maintenance recovery kit and planned improvement of the intermediate maintenance recovery kit.

• The majority of recovery will be accomplished by air; however, ground evacuation capability is still required.

Night Maintenance.

Background: Units are staffed for 12-hour operations. Current doctrine states that Aviation units with AVUM capabilities should organize personnel resources into teams which will allow for a 24-hour maintenance capability. The night maintenance potential for AVIM units is greater due to the fact that AVIM units are located farther to the rear and the considerations of light and noise discipline are not as critical. It is currently recommended that for extensive maintenance performed in rear areas, white light be used to obtain maximum efficiency and rapid return of aircraft. The frequency and type of night maintenance required is dependent on the scenario and flying hour rate experienced. Materiel actions have focused on developing lightproof shelters such as the transportable helicopter enclosure and the nondivisional AVIM shop set.

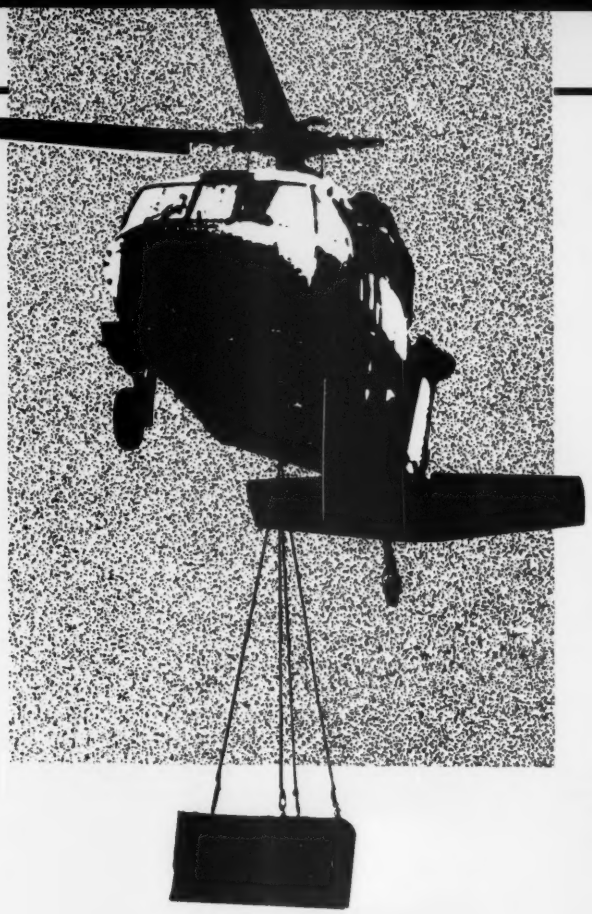
Conclusions:

• Night maintenance must be conducted in all geographical areas of the battlefield.

• We anticipate a high percentage of night flying, which will reduce the opportunity to perform night maintenance.

Forward Support Battalion.

Background: The CAB as currently designed will receive administrative and logistical support from the division support command (DISCOM) on an area basis. Units operating in a brigade area will be supported by DISCOM from the support battalion in the brigade support area (BSA). Conceivably, Aviation could receive support from each BSA as well as from the main



support battalion in the division support area.

Advantages of a forward support battalion for the CAB are that the FSB establishes a habitual relationship for support and allows the brigade to coordinate for support at one location. It also places, as the logistical operator for the brigade, a lieutenant colonel who is attuned to the function of DISCOM and is coequal with the other support battalion commanders.

Disadvantages of an FSB for the CAB are that it will require the FSB to have the capability to provide support across the entire division area. Personnel increases required to build the FSB are not supportable in the Army of Excellence.

Conclusions:

- The FSB is a highly emotional issue. Ideally, if it were affordable, a separate FSB should support each divisional CAB.
- Corps CAB may require a dedicated FSB when operating in the division.

Aircraft Maintenance Company Mobility.

Background: In the 9th Infantry Division, the aircraft maintenance company was removed from the combat support Aviation battalion and placed under the control of the newly formed forward support battalion (DISCOM) in support of the cavalry brigade air attack (CBAA). The aircraft maintenance company, by table of organization and equipment (TOE) design, has about a 50 percent mobility capability for TOE equipment and personnel when administrative loading techniques are employed. However, due to tactical loading, "in lieu of" equipment, and the addition of newly fielded specialty equipment, a degradation of the actual mobility capability is experienced. The aircraft maintenance company of the Infantry division light (IDL) is assigned to the DISCOM. Although mobility of the aircraft maintenance company was not considered as a design factor, the unit is about 38 percent mobile by weight and cube. The heavy division, airborne and air assault aircraft maintenance units currently being developed are also assigned to the DISCOM.

Conclusion:

- TOE design (50 percent mobility) requires the aircraft maintenance company to displace by echelon (bounds) in order to provide continuous support to the CAB.

Combat Aviation Brigade Mobility.

Background: The original design of the CAB required the maneuver elements to be 100 percent mobile in organic vehicles. This means that the cavalry squadrons, attack helicopter battalions and combat Aviation assets could relocate

from one location to another in just one move. Transportation assets other than their own organic vehicles would not be required. Included in this transport capability were sufficient vehicles to move a 2-day supply of Classes III and IIIA computed at AAMAA flying hours and the unit's basic load of Class V. These mobility requirements are applicable to all CABs with the only exception being the CAB of the IDL which was designed to operate from a fixed base.

Conclusion:

- Mobility is adequate; however, logistics elements must be task organized to support forward or laterally deployed units. Prescribed load list (PLL) and other classes of supply reduce mobility of the CAB.

Test Equipment.

Background: Historically, each weapon system developer and support manager has looked vertically at the development and support of his weapon system, maximizing for the weapon but sometimes suboptimizing for the Army. Automatic test equipment (ATE) requirements on the battlefield have tended toward system unique solutions, thereby proliferating ATE and causing an unacceptable burden in terms of personnel, vehicles, generators and logistical support. This is particularly true in the divisional and nondivisional maintenance area. The project manager for TMDE has been chartered to reduce this proliferation by developing a family of general purpose ATE which can be configured into commodity oriented sets to provide testing across the full spectrum of electronic, electro-optical and other general test requirements.

Conclusions:

- Stop proliferation.
- This is a problem of serious magnitude; we must keep weight and size feasible for all items.

Army Air Transport.

Background: The Aviation Logistics School is responsible for drafting external air transport doctrine, training and materiel management. Field Manual (FM) 55-450-1, the document implementing external air transport doctrine, is under revision and expected to be published in the third quarter of FY 85. Changes to the manual include a greater number of equipment loads, more detail of unit responsibilities, a new chapter on selection and preparation of landing sites, and rigging procedures for the old family of slings (aerial delivery and multileg). A core program of instruction on external air transport has been written for distribution to other TRADOC schools. Materiel developments in this area have centered on the new family of slings and nets, the helicopter internal cargo handling system developed for the CH-47 and the internal/external pallet.

Conclusions:

- Current doctrine is adequate.
- Current doctrine dictates improvement in cargo handling equipment and techniques both for internal and external operations.

Rear Area Combat Operations and Protection.

Background: Normally, combat support (CS) and combat service support (CSS) units are grouped into base and base clusters to enhance defense against level II and III threats and to allow continued execution of the CS and CSS mission. The base is a small geographical area under the senior commander while the base cluster is a larger area containing several bases for mutual security.

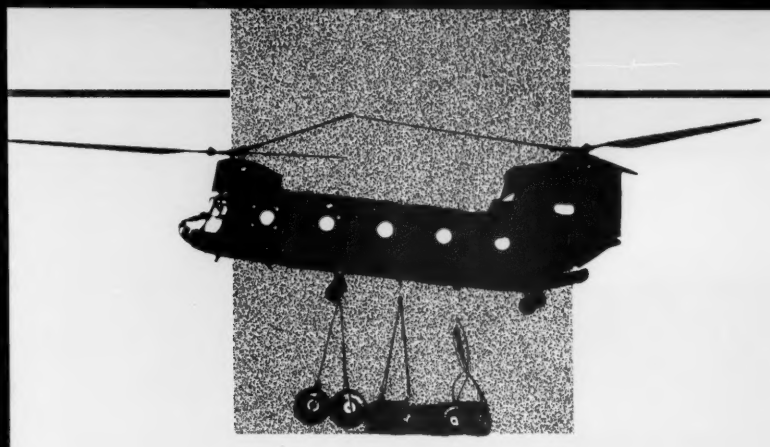
The rear area operation center designates base cluster commanders and provides centralized tactical planning and control within the rear battle.

When threat forces exceed defense capabilities, military police provide initial forces to defeat the threat with combat forces following as required.

For Aviation CSS units operating forward (for example, a FARP in the vicinity of a maneuver brigade support area), coordination must be made with the brigade to incorporate mutual security and to control movement of the Aviation assets.

Conclusion:

- Current down-sized Aviation maintenance and FARP organizations must be assigned a RACO or RAP mission only in an emergency tactical situation. They cannot continue their primary mission plus RACO/RAP.



Classes VII And IX Provisioning and Distribution.

Background: Class VII (major end items such as launches, tanks, mobile machine shops, vehicles): The Army Aviation Systems Program Review, specifically the Organization and Force Structure Panel (September 1982 *Aviation Digest*) addressed the absence of aircraft in war reserve stock (WRS) and pre-positioning of materiel configured to unit sets (POMCUS). Although it was recognized that ground systems have an acquisition strategy which provides replacements for attrited systems from war reserve stocks, regulatory restrictions may preclude aircraft being placed in either WRS or POMCUS. The panel recommended exploiting self-deployability, continuation of tests in Europe to determine if aircraft could tolerate extended storage, revision of regulations and development of an acquisition strategy which includes WRS.

The Joint Concept Validation Program for placing fully mission capable (FMC) aircraft in pre-positioned storage was conducted in Europe from January 1982 to March 1983 (March 1984 *Aviation Digest*, page 2). The program established that AH-1S (Modernized Cobra) and other less complex helicopters may be stored fully fueled and with minimum preservation for up to 13 months in a controlled-humidity warehouse environment and remain FMC.

Class IX (repair parts and components to include kits, assemblies, etc., required for maintenance support of all equipment): Currently, PLLs are kept to support a unit's daily organizational maintenance operation in combat for a prescribed number of days. Combat PLL parts are to be used and replenished as necessary; they are not to be boxed and banded. A combat PLL requires stockage of mandatory parts lists and most of the items stocked on PLL.

Conclusions:

- The combat PLL and authorized stockage list, to be identified by the Army Materiel Command, must be completed as soon as practicable. These preplanned supply support packages or "pull" packages will increase sustainability in the early days of a conflict.
- War reserve funds for Class IX must be increased.
- We must use POMCUS for Class VII.
- We should buy spares and repair parts to sustain, possibly at the expense of reducing the total number of end items.

Summary.

AVLOG-84 was a timely and valuable experience for the Army Aviation community as well as those not familiar with Aviation. Because of the split responsibilities for Classes III and V, ground maintenance and the the other elements of Aviation logistics, it served as an education forum and provided the opportunity for all proponents to develop the package of employment and logistics necessary for successful combat Aviation operations.

With weapons systems ever increasing in technological sophistication, it is vital that Aviation logistics keep pace. During his keynote address, MG Lilley described two essential programs designed to achieve this—the Aircraft Combat Maintenance Battle Damage Repair Program and Progressive Phased Maintenance (PPM). Both are applicable in wartime, with PPM potentially increasing availability and mission flexibility in peacetime as well. Within safety constraints, PPM may provide an overall manhour to flight hour savings by requiring fewer inspections and extending the interval on others. These programs could help offset part of the difference between the established DA wartime flying hours planning figure (AR 570-2) and the required wartime flying hours developed by the Aviation community in the AAMAA.

By continuing to explore new and innovative ways of providing Aviation logistics support, Army Aviation can better exploit its unique mobility and firepower against an opposing force. But, as MG Lilley observed in his keynote address, "Aviation logistics is the most critical aspect of Aviation power, and without logistics it could very well restrict the employment of the commander's Aviation assets." Simply stated, employment and logistics are inseparable and must be considered together.

Holding Entries Made Simple (or how to beat the checkride blues)

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The views expressed in this article are the author's and do not necessarily reflect Aviation School policy. The author is a National Guard instructor pilot on special assignment to the Aviation Center

IMAGINE YOURSELF on an instrument checkride. You are about halfway through the ride and feeling rather proud of your performance. In fact, you only have one last approach and a holding procedure left (probably to be completed back at the home plate) and you will be recertified good-to-go for another year.

Then all of a sudden it happens without warning! Something that is feared by some and dreaded by many. Your check pilot issues you a completely unanticipated and fairly off-the-wall holding clearance at the worst possible fix he could find. You figure you have only 3 or 4 minutes before you reach the fix and time to plan is at a premium. Your thoughts stray to your opinions on unrealistic holding clearances, cocky check pilots and how to remain calm.

Does this sound familiar? If so, then read on because you are going to learn about a technique for holding entries that is super easy and virtually foolproof. It is so easy that you do not even need to visualize the holding pattern or your relative position within the holding pattern. (The only technique I know to be easier is to refuse the clearance—which has been tried on occasion.) This technique works at NAVAIDs (navigational aids) or intersections and automatically takes into account the effects of wind.

The only requirement for this technique to work properly is that you must be heading (or tracking if you prefer) *directly* to the fix. Then all you need to know are three items:

- The outbound course.
- Whether the holding pattern is right or left turns.

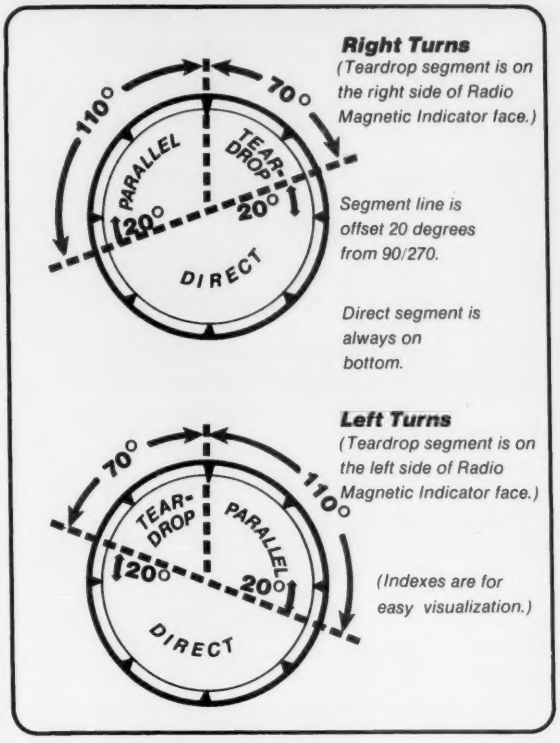

FIGURE 1: RMI Segment Procedure.

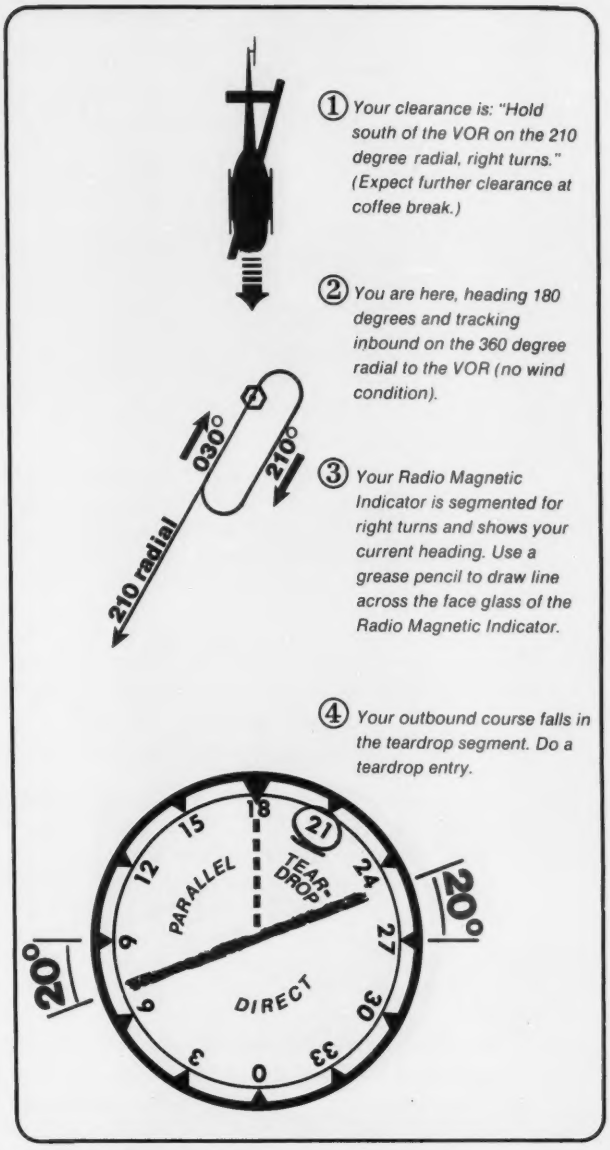
1 Your clearance is: "Hold south of the VOR on the 210 degree radial, right turns." (Expect further clearance at coffee break.)
2 You are here, heading 180 degrees and tracking inbound on the 360 degree radial to the VOR (no wind condition).
030°
210°
210 radial
3 Your Radio Magnetic Indicator is segmented for right turns and shows your current heading. Use a grease pencil to draw line across the face glass of the Radio Magnetic Indicator.
4 Your outbound course falls in the teardrop segment. Do a teardrop entry.
PARALLEL
TEAR-DROP
DIRECT
20°
20°

FIGURE 2: Example.

• The procedure for segmenting the radio magnetic indicator (RMI).

Now, the way this works is simple. After you receive a holding clearance, mentally segment the face of the RMI. (Some folks draw a line across the face glass of the RMI with a grease pencil when first learning this technique.) Each segment represents a specific entry procedure (i.e., either teardrop, parallel or direct). See figure 1—RMI Segment Procedure. Next, locate the outbound course on the RMI compass card and note the segment into which the outbound course falls. If the outbound course falls in the teardrop segment then perform a teardrop entry. If it falls in the parallel segment then do a parallel entry, and if it is in the direct segment, do a direct entry.

Review the simplified example in figure 2 and set up some of your own examples on the chalkboard. You will be amazed because it works every time (if it doesn't, recheck your figures because you made a mistake). Master this technique and I guarantee that you will be able to dazzle your check pilot with brilliance, impress your copilot with finesse and win bets at the club.

The Aviation Digest welcomes short articles for use in this Instrument Corner.

U.S. Army Communications Command
ATC ACTION LINE

RPV Operations

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Cameron Station, Alexandria, VA

THE FIRST QUESTION might well be, "What is an RPV?" For the purpose of this discussion, an RPV is a winged aerial vehicle that is controlled by means other than a human in the cockpit (a remotely piloted vehicle). This may be accomplished by radio or radar navigation systems, computer programing or by any other means other than directly by a pilot. Regardless how they are controlled, all RPVs will be operated in accordance with the procedures contained in Federal Aviation Administration Handbook (FAAH) 7610.4, "Special Military Operations."

The second question may be, "Why does the Army have to comply with FAAH 7610.4?" The answer to this is simple. By federal law the FAA is charged with the management of the National Airspace System (NAS). Thus, the FAA established the rules, regulations and procedures by which operations in the NAS are to be conducted.

The following is extracted from FAAH 7610.4, paragraph 1500.

Since RPVs do not have see-and-avoid capability, operation of these vehicles must be rigidly controlled to avoid hazards to other air traffic. Operation of RPVs shall be limited as follows:

- **Within positive control areas.**
- **Within restricted areas.**
- **Within warning areas.**
- **Outside of the above areas, the RPV must be accompanied by a chase plane with direct communication with the controlling source facilities. It is the chase plane pilot's responsiblity to relay potential conflicts to the controlling source facilities and provide changes of heading and altitude to resolve any traffic conflicts. If an alternate means of observing RPV flight and communications with the controlling source facilities is available, which would provide a level of safety equal to that provided by the chase plane, it may be approved at the discretion of the concerned FAA region. This may include visual observation from one or more ground sites, RPV flight monitoring by patrol aircraft, primary radar observation or the controlled firing area concept. Operations shall be conducted in VFR (visual flight rules) conditions.**

Army RPV operations will normally be conducted within a restricted area. The following guidelines apply:

- **If a restricted area exists and has been approved for RPV or similar activity, operations may be initiated immediately.**
- **If a restricted area exists but has not been approved for RPV operations, FAA must be advised. Depending upon circumstances, rulemaking action may be required.**
- **If no restricted area exists, action must be taken to establish one. It is stated Army policy that activities requiring special use airspace will not be conducted unless that airspace has been designated by FAA.**

NOTE: FAAH 7610.4 is directive in nature on the Department of Defense and is implemented for the Army by Army Regulation 95-50.

For additional information or clarification, contact Mr. Jesse M. Burch, AUTOVON 284-7796/6304.

Readers are encouraged to address matters concerning air traffic control to
Director, USAATCA Aeronautical Services Office, Cameron Station, Alexandria, VA 22304-5050.

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